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Particularities of cardiovascular rehabilitation after coronary artery bypass graft: a case report

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Abstract

Objectives. This paper assesses the importance and contribution of cardiovascular rehabilitation programs in the short- and long-term outcome following surgical revascularization procedures for patients with coronary artery disease (CAD). **Methods.** We present the case of a 64-year-old patient who benefited from a coronary artery bypass graft (CABG) procedure for CAD, followed by an individualized cardiac rehabilitation program. The case particularity consisted of the presence of associated peripheral vascular disease that imposed additional challenge in decision-making process regarding surgical therapy. **Results and discussion**. Immediately after surgery, the patient was included in a phase II residential recovery program, preceded by a ramp effort test. The rehabilitation program consisted of partial toning massage of the lumbosacral spine, and individual physiotherapy. Coronary revascularization procedures often cause lowered exercise capacity and declining physical activity levels. In our case even preoperative assessment showed a limited physical effort capacity, further reduced by the surgical intervention. The physiotherapy plan should be personalized, safe, effective, and must increase the independent mobility of patient soon after open heart surgery. **Conclusions**. The main contribution of cardiac rehabilitation program should be the improvement of physical and social status of patients undergoing surgical myocardial revascularization. This program should be included in the management of all cardiac heart disease patients who benefit from cardiac surgery procedures. Implementation of CR programs at most hospitals and community centres, as well as awareness about their efficacy, would result in higher participation after coronary revascularization interventions and improvement of functional parameters and quality of life.

Key words: *cardiovascular rehabilitation, coronary artery disease, myocardial surgical revascularization, short- and long-term outcome,*

Introduction

In patients suffering from coronary artery disease (CAD), the surgical intervention for myocardial revascularization can bring a major impact on the overall lifestyle and usual physical activities; this can result in critical physical impairment and a reduced quality of life. In order to avoid this situation, the inclusion of such patients in cardiovascular rehabilitation programs immediately after surgery could be beneficial in almost every case.

In Europe, cardiovascular diseases represent the main causes of death: 40% in men (19% - ischemic heart disease) and 49% in women (19% ischemic heart disease) (1). Also, cardiovascular diseases are the main cause of mortality in Romania. Of these, acute coronary syndromes (ACS) are responsible for more than half of the deaths (2).

Cardiac rehabilitation is an important component of current multidisciplinary approach to the management of the patients with various presentations of coronary heart disease. Cardiac rehabilitation involves exercise training, education, counseling regarding risk reduction and lifestyle modification, and, frequently, behavior interventions (3).

Cardiac rehabilitation (CR) programs are recognized as integral to comprehensive care of CHD patients and have been given a Class I recommendation from the American Heart Association, the American College of Cardiology, and the European Society of Cardiology, with exercise therapy consistently identified as a central element (4).

Although CABG has become less likely to be life-threatening, patients who have undergone the procedure may still have a risk of subsequent ischemic events which can extend to atherosclerosis in the grafted vein. Furthermore, such patients may experience difficulties in turning back to normal activities of daily living because of (1) misconception that activity should be limited, (2) generalized muscle weakness after surgery owing to the lack of use. These reasons may eventually have a negative impact on the psychological status and quality of life of the patient (5).

2. Case presentation

A hypertensive 64-year-old man, known with chronic peripheral arterial disease (left subclavian artery, terminal aorta) and diagnosed with multi-vessel cardiac ischemic disease and cardiac failure (NYHA Class II), was admitted in January 2020 in the Cardiology department for anterior chest pain triggered by physical effort and low temperatures, and relieved by nitrates; the patient also accused intermittent claudication at approximately 200 m.

Measuring the arterial brachial pressure revealed a gap of 25 mmHg between the right and left side, and the radial pulse was reduced also on the left side; the femoral, popliteal and tibial pulse was absent bilaterally. The ECG showed sinus rhythm at 72 beats / minute, and a left ventricular hypertrophy with mixed terminal phase changes. The physical exam also revealed a left carotid and abdominal aorta murmur. The laboratory findings were suggestive for an infective inflammatory syndrome.

The diagnostic coronary angiography confirmed the presence of severe atherosclerotic lesions located on the left main, left anterior descendant, circumflex and right coronary artery. In addition, it confirmed the left subclavian artery occlusion immediately after origin and the severe atherosclerosis of brachiocephalic trunk; the abdominal aorta was also chronically occluded below renal arteries origin. In these circumstances, the case was referred to surgery.

In the pre-operative assessment, trans-thoracic and trans-esophageal cardiac echography were performed. The trans-esophageal exam raised a suspicion regarding the presence of a mobile, echogenic small tumor (area of 0.39 cm^2) (possible fibroelastoma) on the posterior mitral valve, with no interference with valvular function. In contrast, the trans-thoracic echography found only a calcified posterior mitral ring, and a papillary muscle fibrosis.

For a more accurate case evaluation and determination of surgical strategy, a contrast-enhanced computed tomography of the aorta and its major branches was indicated. The imagistic findings included a narrowed internal thoracic artery, a totally occluded left subclavian artery and infrarenal aorta, and a severely stenotic (80%) right subclavian artery. Consequently, the patient had no indication for arterial graft myocardial revascularization.

The patient benefited from a triple coronary bypass intervention with saphenous vein grafts. Postoperatively, inotropic drugs for 72 hours and blood transfusion were necessary in order to correct the hemodynamic status and post-operative anemia. In the 13^{th} day after operation, we noticed the presence of minimally inflammatory secretion at the inferior 1/3 of the sternal surgical wound, accompanied by fever (38.8˚C); under local antiseptic and empiric antibiotic therapy (due to negative lab results for surgical wound secretion and hemocultures), the clinical signs diminished significantly in about one week.

At discharge, the patient was referred to a cardiologic rehabilitation centre, in order to complete an individualized recovery program.

The cardiovascular rehabilitation program

The recovery program was performed at Polaris Hospital for 7 days immediately postoperatively. Before patient's inclusion in this program, we took into account the general context. Let us not forget that in general, patients undergoing surgery are physically deconditioned and, when the correction of heart disease is performed surgically, the capacity for effort may remain reduced (6). At the same time, due to the sedentary lifestyle, a progressive increase of the effort capacity is needed, in order to avoid the appearance of some cardiac symptoms.

Inclusion in the training program was preceded by a ramp effort test.

The recovery program included:
-partial massage - sedative / slightly toning massage at the level of the lumbosacral spine
-individual physiotherapy: respiratory gymnastics, short distance walking exercises, exercises for maintaining joint mobility, Williams II and III exercise, exercises for improving physical condition and muscles
Isometric exercises were avoided.
Physical training was moderate, with a heart rate between 50-60% of the maximum peak frequency reached on the exercise test. The intensity and duration of the effort increased gradually, and then the training was carried out at 70-85% of the maximum heart rate reached on the exercise test. Interval training is preferred.
At discharge, it was recommended to continue constant physical activity, at least 5 days a week, at the level of effort depending on the capacity recorded.

3. Discussion

We presented the case of a patient who benefited from coronary artery bypass graft (CABG), who was then included in a phase II residential recovery program. For a truly beneficial effect of training programs, at least 36 sessions are required in this phase II (50-60 sessions in the case of severely physically ill patients) (6).
In the last decades, the use of less invasive techniques became more important in the therapeutic arsenal of the open-heart surgery (6,7,8). Also, at present time, the first-line treatment of patients with acute coronary syndrome (ACS) is percutaneous coronary intervention (2).
Despite all the therapeutic advances, there are still patients who cannot benefit from these procedures and need a more aggressive intervention that can lead to a temporary physical impairment. In our case, the coronary arteriography and thoracic CT-angiography demonstrated that the coronary lesions were not suitable to a minimally invasive approach.
The postoperative complication that occurred in our patient – the systemic and local inflammatory reaction – caused a delay in the complete recovery, and in the initiation of postoperative cardiac rehabilitation program also.
Traditionally, cardiac rehabilitation has been provided to somewhat lower-risk patients who could exercise without getting into trouble. However, astonishingly rapid evolution in the management of CAD has now changed the demographics of the patients who can be candidates for rehabilitation training (3).
Many studies have shown that a left ventricular ejection fraction (LVEF) ≤ 35% is associated with a reduced long-term survival in patients on medical therapy and increased early mortality in those undergoing coronary artery bypass grafting (CABG) (9). In this category of high-risk patients, their inclusion in a rehabilitation program is mandatory for better postoperative results. But in order to do so, the left ventricular dysfunction should be appropriately corrected. In our case even preoperative assessment showed a limited physical effort capacity, further reduced by the surgical intervention.
Cardiac rehabilitation for post-CABG patients is a well-known management option implemented in the USA, UK, Canada, and Australia (10). However, in our country this subject of rehabilitation has not gained yet full attention, despite the increased incidence of CAD.
The protocols for cardiac rehabilitation during hospitalization are different. There are protocols that demonstrate a progression in which individuals go through stages (steps) that evolve according to their recovery, and others as a daily rehabilitation, adopting different therapeutic strategies in postoperative period, both in cardiac rehabilitation after acute myocardial infarction as in the post-operative period of cardiac surgery (10).
Coronary revascularization procedures often cause lowered exercise capacity and declining physical activity levels.
These outcomes are paramount in predicting morbidity and mortality after these procedures. Cardiac rehabilitation (CR) focuses on incrementing cardiovascular endurance, exercise capacity, muscle strength, levels of physical activity, and quality of life through health education and lifestyle modification in post-coronary revascularization patients (11).
The reasons for the beneficial effect of early rehabilitation are unclear, although the consequences of aerobic exercise have been widely studied, at least from a cardiological
point of view. Isotonic work, not only regularly repeated in the form of so-called ‘endurance

exercise training' but also acutely performed, is followed in the recovery phase and in the medium to long term by a reduction in systolic and sometimes diastolic blood pressure (12).

As mentioned in other studies (13), a personalized physiotherapy plan, devised to increase independent mobility soon after open heart surgery is safe, feasible, and more effective than routine cardiac rehabilitation program. In our case, the patient was referred to a rehabilitation centre immediately after he was discharged from our service; therefore, the cardiac rehabilitation program begun relatively soon after cardiac surgery.

The goals of CR include improvement in exercise tolerance and optimization of coronary risk factors, including improvement in lipid and lipoprotein profiles, body weight, blood glucose levels, blood pressure levels, and smoking cessation. Additional attention is devoted to stress and anxiety and lessening of depression (14).

The patient must start his activity as soon as possible after the surgery by doing some light exercises and moving the body in bed and gradually will ask the patient to sit on the chair and then walk. The type of movement required will be decided according to each patient separately and under the guidance of the doctor. As for sleep conditions, sleep on the back and help at the beginning of entry to or out of bed so as not to load the entire body weight on the patient's arm, which affects the healing bone cut (15).

Patient's after CABG are prescribed with a complex drug regime and recommended to adopt a healthy lifestyle, including smoking cessation, diet, moderate exercise, and psychological
stress control. The adherence to these behaviors is usually voluntarily adopted early after CABG but becomes more difficult in the long term (16).

Considering the patient's need to obtain a full and prompt physical recovery after surgery to allow a fast normalization of daily life activities (including return to work), linked with the need to adopt a healthy lifestyle and the specific pharmacological regime for a lifetime, cardiac rehabilitation (CR), recently defined by the British Association for Cardiovascular Prevention and Rehabilitation as, "...the coordinated sum of activities required to influence favorably the underlying cause of cardiovascular disease, as well as to provide the best possible physical, mental and social conditions, so that the patients may, by their own efforts, preserve or resume optimal functioning in their community and through improved health behavior, slow or reverse progression of disease," seems to be the perfect recommendation for early post-CABG patients (17).

4. Conclusions

The main contribution of cardiac rehabilitation program should be the improvement of physical and social status of patients undergoing surgical myocardial revascularization. This program should be included in the management of all cardiac heart disease patients who benefit from cardiac surgery procedures.

Implementation of CR programs at most hospitals and community centres, as well as awareness about their efficacy, would result in higher participation after coronary revascularization interventions and improvement of functional parameters and quality of life.

Informed consent

An informed consent was obtained from the patient participating in the study.

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