**„LUCIAN BLAGA” UNIVERSITY OF SIBIU**

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# RECOVERY OF THE ELDERLY PATIENTS WITH ISCHEMIC HEART DISEASE

***SUMMARY OF THE PhD THESIS***

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## Introduction

Cardiovascular disease is currently the leading cause of death worldwide, with an extremely high mortality in Eastern Europe and in our country. Therefore, today, great emphasis is put on the cardiovascular recovery, particularly in the patients with ischemic heart disease. Although in the era of myocardial revascularization, there are significant changes in the recovery process - which is no longer designed as having three distinct stages, but it is rather an ongoing process – this one has not lost its importance. Within this context, though in Romania there are relatively few rehabilitation centres, the Cardiovascular Diseases Hospital of Covasna is a "unique model" of cardiac rehabilitation, both in Romania and in Europe. Therefore, this paper aims at analysing the features of rehabilitation programmes within this institution, as well as the profile of the patients who are hospitalized there.

## Working hypothesis

On long term, the patients with cardiovascular disease especially, and those with ischemic heart disease in particular, should follow complex rehabilitation programmes, in which a central role is played by the physical training. There are very few studies in Romania to assess the extent to which elderly patients with ischemic heart disease follow real rehabilitation programmes.

## Objectives of the study

1. The role of exercise testing in prescribing rehabilitation programmes in patients over 65 years old.
2. Distribution of cardiovascular risk factors in the elderly patients with ischemic heart disease.
3. Assessing the risk profile of the patients in terms of gender.
4. The value of the ankle-brachial index in prescribing cardiac rehabilitation methods.
5. The role of physical training in cardiac rehabilitation in the patients aged over 65 years old.
6. The role of mofette therapy in cardiac rehabilitation in the patients aged over 65 years old.
7. The role of electro-physiotherapy in cardiac rehabilitation in the patients aged over 65 years old.

8. The role of aerotherapeutics in cardiac rehabilitation in the patients aged over 65 years old.
9. The role of $CO_2$ water bath therapy in cardiac rehabilitation in the patients aged over 65 years old.

**Personal contribution** is represented by four separate studies, formed into 4 chapters, interconnected by the causality of their conclusions.

## The role of exercise testing in the patients with ischemic heart disease and heart failure who are over 65 years old

**Method.** There were included in the study 49 patients with HF NYHA functional class II-III of ischemic etiology without congestive cardiovascular syndrome who were divided into two groups: group 1 - under 65 years old and group 2 – above 65 years old. HF was defined by the 2012 ESC criteria.

**Results and discussions.** There were recoded the following values of the echocardiographic parameters of the patients in the two groups: left ventricular end-diastolic volume - 57 ± 9 vs. 56 ± 8 mm, p = 0.27; left ventricular end systolic volume - 42 ± 11 vs. 40 ± 11, p = 0.21; ejection fraction calculated per volumes - 42 ± 10 vs. 51 ± 16, p = 0.045. Diastolic dysfunction was present in 32%, respectively in 25% of the patients. There were no significant differences between the two groups in terms of the parameters of the effort testing, except for the number of Watts performed, which was much lower in the group of the elderly patients. One important thing to stress is that effort testing was discontinued in the majority of patients with HF, regardless of age, because of dyspnea. At the same time, over 50% of patients had inconclusive exercise testing due to not reaching the maximum frequency.

Heart failure is accompanied by an increased rate of the number of days of hospitalization and significant mortality, which increase with age. In our study, which is consistent with the results of other recent studies, elderly patients had a significantly lower ejection fraction than those aged below 65 years old.

Recent evidence suggests that physical exercise has beneficial effects in heart failure. Within the cardiovascular rehabilitation programmes, the most important objective is the physical exercise achieved by prescribing some individual levels of physical activity, which are safe for the patient and which result from the prior effort testing. Exercise testing allows the objective assessment of the exercise capacity and of the symptoms which occur due to effort, such as dyspnoea and fatigue. In general, especially in elderly patients, but not only, there is used an initial assessment by the 6-minute walk test, which by simplicity and easier and justified compliance of the sick, offers the advantage of rigor in the selection of patients and following their behaviour within the rehabilitation programmes.

In the present study, there has been used the classical testing effort, but only after the relief of the congestive phenomena, so after cardiac compensation. In the vast majority of patients, the exercise test was stopped for dyspnoea, this one being followed by anginal chest pain and asthenia. It is well known that the dominant symptom in heart failure is dyspnea. Within this context, obviously, in more than half of the patients, the effort tests were inconclusive due to the non accomplishment of the maximum frequency, as a result of the low exercise capacity of the patients.

A small number of patients had positive tests (given the etiology of HF in our study - ischemia) and negative. Elderly patients reached a significantly lower number of WATTs than those aged below 65 years old. However, the number of METs and the maximal heart rate were lower in group 2. Obviously, taking into account all these results, different physical training programmes will be established that will be followed by the two categories of patients. Given their cardiac pathology, these programmes will be applied at least for a period of time only under medical supervision and only in centres specialized in this respect, an example being the Cardiovascular Diseases Hospital of Covasna.

**In conclusion,** the testing effort in its classical form can be useful for assessing exercise capacity in the patients with HF who are undergoing a cardiac rehabilitation programme.

## The role of exercise testing in the patients with ischemic heart disease and valvular heart disease aged over 65 years old

It is well-known that valvular pathology influences the exercise capacity. On the other hand, the stress test is particularly useful in assessing the symptoms and the cardiac functional reserve.

**Method.** We have studied 35 patients aged over 65 years old admitted to the Cardiology Ward of the Rehabilitation Hospital of Cluj, with the diagnosis of ischemic heart disease and different valvular pathologies. In all patients, the cardiovascular risk factors were determined and the patients were submitted to echocardiograph and stress testing.

**Results and discussions.** Except for the triglycerides values, none of the studied lipid parameters have reached the values recommended by guidelines. The mean values of the systolic or diastolic blood pressure were close to those recommended by the latest guidelines (<150/90 mmHg). Regarding valvular heart disease, the most predominant was the mitral and tricuspid insufficiency. Submaximal heart rate was on average of 77.54 ± 9.98%. Duke mean score was of 5.54 ± 4.27, classifying the patients in a low risk class. However, the Duke score was correlated with the patients' age.

According to the EuroHeart Score, in the patients over 65 years old, aortic stenosis and mitral regurgitation predominate. In our study, these were present in 8.75%, respectively 34.28%, on the first place being the tricuspid insufficiency - 45.71%. In more than 40% of patients, there was an association between mitral and tricuspid insufficiency. Exercise testing is useful in the patients with aortic stenosis, both for the assessment of the exercise capacity and prognosis and for surgery decision. The Duke score can make a conjunction of electrocardiographic abnormalities with the clinical data of the patients, for a more precise determination of the risk of cardiovascular events. In literature, there are few data that relate to the use of the Duke score in the elderly patients. In a study published in 2007, in the elderly patients, the following results were obtained after the effort testing: double product: 24,946 ± 4,576, with a predominance of a Duke score with moderately high risk. The results of the effort testing were in general correlated with the risk of major cardiovascular events occurrence, at the same time representing a "cheap and effective" modality to assess the elderly patients with coronary heart disease.

Effort testing is useful for prescribing the rehabilitation programmes in the patients with degenerative valvular heart disease, as well.

**In conclusion,** exercise testing is useful and mandatory in the elderly with coronary heart disease and degenerative valvular disease, who are to be included in cardiac rehabilitation programmes.

## Ankle-brachial index value in prescribing cardiac rehabilitation methods

**Method.** We have studied 36 patients with ischemic heart disease hospitalized in the Cardiovascular Diseases Hospital of Covasna, 57.75% women with a mean age of 71.54 ± 5.66 years old, who were assessed in terms of all cardiovascular risk factors, including the ankle-brachial index, and who have undergone rehabilitation programmes in the Cardiovascular Diseases Hospital of Covasna.

**Results and discussions.**

Surprisingly, in elderly patients, there was no significant correlation between the ankle-brachial index and some cardiovascular risk factors taken into consideration. Regarding the different cardiovascular rehabilitation procedures, mention must be made of the fact that most patients received aerotherapy, $CO_2$ water bath therapy, electrotherapy. It was found that there is a direct, significant correlation between the ankle-brachial index value and the indication to use mofette as the cardiovascular recovery procedure ($p = 0.03$ – right and $p = 0.05$ p - left).

Therapeutically speaking, an important part in the management of patients with peripheral arterial is played by rehabilitation. Cardiac rehabilitation, in general, and the physical exercise, in particular, plays a key role in increasing survival and decreasing the rate of major cardiovascular events (myocardial infarction, stroke and sudden cardiac death) in all patients with cardiovascular pathology. Regarding the Covasna “model” of cardiac rehabilitation, an important part is played by the natural factors: climatotherapy, $CO_2$ water bath therapy, mofettes, aerotherapy, as well as dosed and monitored physical training, psychotherapy, counselling for lifestyle changes, diet therapy. There are studies that have demonstrated beneficial effects of $CO_2$ baths in the patients with peripheral arterial disease: improving local circulation, increasing the walk distance and improving the intermittent claudication. Mofettes exert important actions on cerebral circulation, peripheral circulation, cardiac hemodynamics (low pre-ejection period, increased ejection period, increased beat flow, increased coronary perfusion). At cutaneous level, it brings about vasodilation. At the level of peripheral circulation, mofettes actions consist of: increased blood flow in the skeletal muscle through arterial vasodilatation achieved by $CO_2$ dissolved in plasma and reaching the level of metarteriole of the skeletal muscle through inhalation, decreased peripheral resistance, decreased minimum blood pressure. Brassai Z et al. showed an improvement of the claudiction index, of the oscillometry values, of the collateral circulation in the limbs affected by peripheral ischemia through mofette therapy.

**Conclusions:**

1. Most elderly patients with coronary heart disease had normal levels of the ankle-brachial index.
2. Most patients received aerotherapy, $CO_2$ bath therapy and electrotherapy; only about one third of patients followed medical physical culture procedures.
3. Of the patients who did not undergo electrophysiotherapy, only 5.88% had the ankle-brachial index <0.9.
4. None of the patients who undergo $CO_2$ baths therapy din recorded a pathological ankle-brachial index.
5. More than half of the patients who were prescribed medical physical culture had pathological ankle-brachial index values.
6. There was a direct, significant correlation between the ankle-brachial index and the recommendation to use mofette therapy as cardiac rehabilitation procedure.

**Profile of the elderly patients with ischemic heart disease following cardiovascular rehabilitation programmes in the Cardiovascular Diseases Hospital of Covasna**

**Method.** I have studied 80 patients aged over 65 years old, 56.2% women, diagnosed with ischemic heart disease hospitalized in the Cardiovascular Diseases Hospital of Covasna to attend cardiac rehabilitation programmes. All patients were evaluated in terms of cardiovascular risk factors and attended cardiac rehabilitation programmes represented by physical exercise, climatotherapy, $CO_2$ baths, mofette therapy, aerotherapy, electrotherapy and hydrokinetotherapy.

**Results and discussions.** In terms of risk factors present, the distribution was as follows: 64 patients (80%) had hypertension, 51 patients (63.8%) had dyslipidemia. It was considered dyslipidaemic, a patient who presented values of the total serum cholesterol greater than or equal to 200 mg / dl or serum triglyceride levels greater than or equal to 150 mg / dl. 14 patients (17.5%) were diabetic and 17 (21.3%) were obese. There were no significant differences between genders regarding the distribution of cardiovascular risk factors (Chi square test). 34 patients (42.5%) followed mofette therapy, 79 (98.8%)

aerotherapy, 70 (87.5%), $CO_2$ bath therapy, 72 (90%) electrophysiotherapy, 31 (38.8%) medical physical culture.

Men were guided in a significantly higher percentage to the mofette therapy (54.3% of men vs. 33.3% of women, p = 0.049, chi square test). There was no difference in the average age of the patients who were referred to aerotherapy as against those who were not indicated this procedure (70.75 ± 0.87 years vs. 66 ± 0.74 years). There was no difference between the average age of the patients who underwent $CO_2$ baths therapy and those who have not been given this therapy (70.71 ± 5.02 years vs. 70.6 ± 3.86 years, p = NS, Student test). 82.2% of women received a prescription for $CO_2$ baths therapy vs. 94.3% of men, the difference being at the borderline of statistical significance p = 0.09, chi square test. Patients' age was not a contraindication for electrophysiotherapy, being similar in the patients receiving this indication as against those who have not done this therapeutic procedure (70.66 ± 4.99 years vs. 71 ± 3.89 years, p = NS, Student test). 86.7% of the women included in the study were referred to the electrophysiotherapy vs. 94.3% of men (p = NS, Chi square test). The average age of those who were guided to medical physical culture was of 69.41 ± 3.76 years old, significantly lower compared with those who did not perform this therapy (71.51 ± 5.34 years, p = 0.044, Student test). Regarding the biochemical profile, there were differences between the two groups on the mean LDL-cholesterol, significantly lower in those who followed medical physical culture. Surprisingly, there were differences in the mean serum triglycerides value, but in the detriment of those who practiced medical physical culture. Both total cholesterol and LDL cholesterol and blood glucose levels were lower in those directed to undergo medical physical culture. Meanwhile, HDL-cholesterol was higher in those who followed medical physical culture. Compared to other procedures, fewer patients were directed to medical physical culture. Only 40% of women and 37.1% of men were prescribed this therapy.

In fact, one can say that the participation rate of the elderly patients in the rehabilitation programme is 1.2-1.3 times lower than the younger patients. Physical training objectives are: to increase the effort capacity (independent prognostic factor), to decrease the coronary risk (through effects on the other risk factors), to prevent the physical related decline over the limits determined by heart disease. The intensity of the physical exercise is the most important factor in prescribing this kind of effort and depends on age, gender, level of effort testing, previous physical condition.

Reaching a submaximal aerobic level (60-80% of the max $VO_2$ on effort testing) has the desired cardiovascular effects. In the patients with heart attack hydrotherapy, in

general, can lead to the increase of the nitric oxide release, improved collateral circulation, cardiovascular remodelling regression, decreased PAI-1 activity. The effects of $CO_2$ bath therapy have been studied mainly in the patients with peripheral arteriopathies.

There are very few studies in the patients with ischemic heart disease. In a study published in 1993, it was shown that the use of $CO_2$ bath therapy, along with the physical training resulted in an improvement of the status of the patients with ischemic heart disease. In another recent study, published in 2012, $CO_2$ baths contributed in those 97 patients with angina class I-II, to a significant decrease in the number of premature ventricular and supraventricular extrasystoles, regardless of gender, at the same time with the decrease in the number of episodes of ischemia (assessed by Holter EEG / 24 hours). However, $CO_2$ baths also exert important hypotensor effects.

**Conclusions:**

1. Between the two genders, there were no significant differences in the mean values of the total cholesterol, LDL-cholesterol, HDL-cholesterol, glucose and uric acid. Women had higher values of the total cholesterol and LDL-cholesterol, while men were found with higher values of glucose and uric acid.
2. The patients who were prescribed mofette therapy were younger, and men have benefited from mofette therapy in a higher percentage than women. The hypertensive, dyslipidemic men were more frequently prescribed the mofette therapy compared with the hypertensive women.
3. Aerotherapy and $CO_2$ baths were indicated in the majority of patients.
4. Patients' age was not a contraindication for the aerotherapy, $CO_2$ baths and electrophysiotherapy.
5. Cardiovascular risk factors were not considered criteria for indicating electrophysiotherapy as a rehabilitation method.
6. The patients following medical physical culture programmes were younger than those who did not benefit from these ones.
7. LDL cholesterol values were significantly lower in the patients receiving medical physical culture programmes.

**Final conclusions:**

1. Effort testing in its classic form can be useful for assessing the effort capacity in the patients with heart failure and valvular heart diseases who are to be subjected to a cardiac rehabilitation programme.
2. The predominant risk factor encountered in the elderly patients was hypertension.
3. Between the two genders, there were no significant differences in the mean values of the total cholesterol, LDL-cholesterol, HDL-cholesterol, glucose and the uric acid. Women had higher values of the total cholesterol and LDL-cholesterol, while men were found with higher values of glucose and uric acid.
4. In the elderly patients, there was no significant correlation between the ankle-brachial index and obesity, hypertension and diabetes.
5. There was a significant correlation between the ankle-brachial index and the levels of total cholesterol and LDL cholesterol.
6. The majority of the elderly patients with coronary heart disease had normal levels of the ankle-brachial index.
7. Chronic obliterative arteriopathy was more often present in women.
8. Patients' age was not a contraindication for the aerotherapy, $CO_2$ bath therapy and electrophysiotherapy.
9. The patients who were prescribed the mofette therapy were younger.
10. Men have benefited from the mofette therapy were in a higher percentage than women.
11. The presence or absence of cardiovascular risk factors was not a criterion for the mofette therapy.
12. Hypertensive, dyslipidemic men were indicated more frequently the mofette therapy compared to the hypertensive women.
13. Over two thirds of the patients with peripheral arteriopahy were indicated the mofette therapy.
14. There was a direct, significant correlation between the ankle-brachial index and mofette therapy recommendation as a cardiovascular rehabilitation programme.
15. Mofette therapy was not indicated in the patients with heart failure.
16. Aerotherapy and $CO^2$ baths were prescribed in the majority of patients.
17. None of the patients who underwent $CO_2$ baths had a pathological ankle-brachial index.

18. Cardiovascular risk factors were not considered a criterion for indicating electrophysiotherapy as a rehabilitation method.
19. Among the patients who did not receive electrophysiotherapy, only 5.88% had the ankle-brachial index <0.9.
20. There were no gender differences in terms of physical training programmes.
21. The patients who followed medical physical culture were younger than those who did not benefit from these ones.
22. LDL cholesterol values were significantly lower in the patients receiving medical physical culture programmes.
23. More than half of the patients who were prescribed medical physical culture had an ankle-brachial index with pathological values.

**Keywords:** elderly patients, ischemic heart disease, heart failure, valvular heart diseases, ankle-brachial index, in-hospital cardiac rehabilitation

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