THE EFFECT OF CARDIOVSCULAR REHABILITATION ON THE EXTENT OF OBESITY AND LIPID RISK FACTORS IN RELATION TO PATIENTS' AGE

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It has been established that multifactorial rehabilitation programs that include physical activity, nutritional education, consulting, psychological support and pharmacological treatment, have the most favourable influence on lipid level.

The Objective was to establish the effect of cardiovascular rehabilitation on the extent of obesity and lipid risk factors depending on the age of patients after myocardial infarction.

The investigated group included 65 years old and older (n=67) patients, average age 72.1±3.2, and the control group with patients younger than 65 years old (n=46) average age 50.7±4.1. Laboraory tests were performed on all the examined both in and out patients (glycemia, lipid status, total cholesterol, HDL cholesterol, LDL cholesterol and triglyceride), as well as waist circumference measurement, body mass (BM) and body mass index (BMI).

A group of older patients, in comparison to a control group of younger patients, did not significantly differ in the extent or type of obesity. The analyses of values, before and after the rehabilitation treatment showed that in both groups of the examined patients and in all patients on CV rehabilitation program, significant reduction in BMI and waist circumeference was found after the RH treatment. In both groups of patients values of lipid parameters (total, LDL cholesterol and triglyceride) and morning glucemia were significantly lower after the RH program had been finished, while the values of HDL cholesterol showed significant increase after the RH program. Values of most atherogenic indexes were significantly higher in younger patients in comparison to the group of older patients.

In both groups of patients on cardiovascular rehabilitation program there were significant reductions of BMI and OS, as well as improvement of lipid disorders and impaired glicoregulation. After the CV rehabilitation, values of all atherogenic indexes were significantly reduced. This is the indicator of the importance of cardiovascular rehabilitation program, especially in the elderly patients desipite the fact that they remained higher in younger patients. Acta *Medica Medianae 2009;48(4): 17-21.*

Key words: *cardiovascular rehabilitation, elderly patients, obesity, lipid disorders*

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Uvod

Concentration of serum cholesterol increases progressively until the age of 50 in men and 65 years of age in women, when it starts to decrease. In the group of patients 65 to 74 years of age, 22 % of men and 41% of women had a total serum cholesterol value higher than 240 mg/dl; in those older than 75 years of age, 20 % of men and 38% of women had total cholesterol value higher than 240 mg/dl (1). Although a combination of the increased serum cholesterol level and development of coronary disease, less emphasized in the elderly, relation of the total HDL cholesterol is a significant prediction of the coronary disease development in the elderly (2). Increased triglyceride is connected with the increased risk of coronary disease in older women, but not in men (3). Therapy with statines can reduce the appearance of acute coronary events in patients younger than 75, while older patients were not analysed in detail(4).

Cardiovascular rehabilitation (CVR), nowadays, represents an integral part of a complex patient therapy after myocardial infarction (MI). Today cardiovascular rehabilitation is characterised by complete and lasting activites that include clinical

evaluation, physical training, modification of risk factors, medication therapy, education lectures, psychological help, counceling concerning patient´s occupation and balneoclimatotherapy (5).

Most elderly patients who have suffered MI or underwent coronary by-pass syrgery are not in the CVR programs (6). Unfortunately, special categories of patients (women, the elderly, patients with heart failure) have been included in the cardiovascular rehabilitation program in recent years. Early rehabilitation in geriatrics is specific in its aim because members of the team carry out rehabilitation, make plans and programs, as well as discuss the prognosis and evaluation of rehabilitation results (5). When compared to younger patients, rehabilitation in geriatrics, on the other hand, is less ambitious, focused on older people and their self care training so that they rely less on family members. In the complex program of cardiovascular rehabilitation in geriatrics, physical training is the essential work method. Prescribed physical exercises adjusted to each individual, have brought significant benefit to older patients, such as as the increase of physical capacity, favorable effect to the obesity index, lipid status and the quality of living (7). The biggest reduction of mortality, by regular and long term physical training has been achieved in older men (8). It has also been shown that older women also have benefit from CVR (8). Rehabilitation programs for older people are safe.

The aim

To establish the effect of cardiovascular rehabilitation on the extent of obesity and lipid risk factors depending on the age of patients after myocardial infarction.

Patients and methods

The investigation was performed as a prospective clinical study at the Institute for Treatment and Rehabilitation "Niška Banja". Investigation was carried out on patients three to six months after MI, who were hospitalized and involved in cardiovascular rehabilitation program.

Total of 113 patients who suffered MI, were analysed. They spent at least three weeks at the Institute "Niška Banja" where they were involved in the complex program of CVR and divided into investigated and control group according to age.
• Investigated group – consisted of 67 patients, aged 65 and older
• Control group– consisted of 46 patients, aged under 65.

All in and out participants had the following examinations and analyses performed:
- clinical examination
- laboratory analyses (glucemia, lipid status-total cholesterol, HDL cholesterol, LDL cholesterol and triglyceride)
- Measuring of waist circumference, body mass (BM) and body mass index (BMI).

Waist circumference (WC) was measured on the upper spine iliac anterior. Values were estimated according to the World Health Organization criteria from 1999 (9).

Body mass index (BMI) was calculated by the formula BMI=BW (body weight)/BH² (body height). Values were taken in kg/m², and estimated according to the World Health Organization criteria from 1998 (10).

Methods of determining the values of atherogenic index:
• Determination of atherogenic index included calculation of relation LDL-C/HDL-C and TC/HDL-C according to NCEP ATP III quidelines (11).
• Determination of atherogenic plasma index AIP=log(TC/HDL-C) according to Frohlich et al (11). Values in heathly persons are about 0, and in diabetics about 0.5.

Methods for modification of dislipidaemia during CV rehabilitation

These measures comprized nutrition (diet, smoking ceasation, increase of physical activity, change of lifestyle), administration of statine medication therapy to improve lipid status and glucoregulation.

According to the initial exercise test the patients underwent intensive type of physical training. Physical training lasted six days a week with an average duration of 20 days. Single training lasted 30-45 min. It was supervised by a physician and consisted of physical exercise, walking, walking up the rise (paths from I to IV), and riding an ergometer bicycle. The intensity of physical training was 60-80% of the achieved heart frequency upon the initial exercise test and the submaximal level where the patient did not show symptoms of load intolerance.

Results

Total of 113 patients who suffered MI were examined. All patients were involved in the cardiovascular rehabilitation program. Essential patients' characteristics are shown in Table 1 and 2.

In the aforementioned investigation, there were significantly more men than women (p<0.01) (Table 5). Average age, patient's age at the moment of MI (p<0.01) and the duration of CVD (p<0.01) were significantly higher in women (Table 1).

In the investigated group of elderly patients, there was no significant difference in the number of men compared to women (Table 2). Average age, age of patients at the moment of MI and duration of CVD did not differ between the sexes in the group of older patients (Table 2).

In the investigated group of younger patients, there was no significant difference in the number of men compared to women (Table 3). Average age, age of patients at the moment of MI and duration of CVD did not differ between the sexes in the group of younger patients (Table 3).

The effect of cardiovascular rehabilitation on the extent of obesity and lipid risk factors depending on the age of patients

The extent and type of obesity did not significantly differ between the examined groups (Table 4). The analyses of values, before and after RH treatment, showed that in both groups of the examined patients and all patients on CV rehabilitation program on the whole, significant reduction of BMI and WV appeared after the RH treatment (p<0.001) (Table 4).

In elderly patients significantly higher values of the morning glycemia were found, before the CV rehabilitation program was performed compared to younger patients (p<0.01); this difference disappeared after the treatment program. Values of HDL cholesterol were significantly higher in the group of elderly patients both before the program and after the CV rehabilitation program (p<0.01) (Table 5).

Lipid parameter values (total, LDL cholesterol and triglyceride) and morning glucemia were significantly lower after the RH program (p<0.001). Therefore, values of HDL cholesterol showed significant increase after the RH program (p< 0.001) in both groups of the examined patients and all patients on the CV rehabilitation program (p<0.001) on the whole (Tabela 5).

Values of most atherogenic indexes were significantly higher in younger patients (Table 6). Only AIP, both before and after the CV rehabilitation program, was similar regardless of patient's age.

Values of all atherogenic indexes were significantly reduced after the RH program in both age groups of the examined patients, and all patients (p<0.001) on the whole (Table 6).

Table 1. General characteristics of the examined patients

	No (%)	age	Age at MI	Time after MI (month)	Duration of CD (years)
women	37 (32.7%)	68±10,2**	67,6±10,2**	4,1±0,8	3,1±3,8*
men	76 (67.3%)**	62,1±10,9	61,8±10,9	3,9±0,7	1,6±3,4
total	113 (100%)	63,89±11	63,5±11	3,96±0,8	2,07±3,6

p<0.05; **p<0.01 vs opposite gender**;**

Table 2. General characteristics of elderly patients

	No	(%)	age	Age at MI (years)	Time after MI (month)	Duration of CD (years)
women	26	38.8	72.8±3.9	72.5±3.94	4.1±0.89	3.6±4.1
men	41	61.2	71.7±2.6	71.4±2.6	3.9±0.85	2.34±4.2
total	67	100	72.1±3.2	71.8±3.2	3.99±0.86	2.84±4.2

NS for all parameters

Table 3. General characteristics of younger patients

	No	(%)	age	Age at MI (years)	Time after MI (month)	Duration of CD (years)
women	11	23.9	49.9±3.6	49.6±3.7	4.1±0.8	1.7±2.3
men	35	76.1	50.9±4.2	50.6±4.2	3.9±0.8	0.7±1.9
total	46	100	50.7±4.1	50.3±4.1	3.9±0.8	0.99±2.1

NS for all parameters

Table 5. Characteristics of lipid parameters and glucoregulation

	older	younger	total
Glycemia before (mmol/l)	7.3±2.5 **###	6.1±1.5###	6.8±2.2###
Glycemia after (mmol/l)	6.3±1.9	5.6±1.0	6.0±1.6
Total cholesterol before (mmol/l)	5.3±1.2###	5.7±1.4###	5.4±1.3###
Total cholesterol after (mmol/l)	4.8±0.9	5.1±1.2	4.9±1.05
LDL cholesterol before (mmol/l)	2.9±1.0###	3.3±1.2###	3.1±1.1###
LDL cholesterol after (mmol/l)	2.65±0.9	2.9±1.1	2.8±1.0
HDL cholesterol before (mmol/l)	1.2±0.2 **###	1.1±0.2###	1.1±0.2###
HDL cholesterol after (mmol/l)	1.45±0.2 **	1.4±0.2	1.45±0.2
TG before (mmol/l)	2.4±1.1###	2.4±0.9###	2.4±1.0###
TG after (mmol/l)	1.7±0.7	1.7±0.6	1.7±0.6

**p<0.01 between the examined groups; ###p<0.001 vs after the RH program

Table 4. The effect of the CV rehabilitation to obesity parameters

	older	younger	total
BMI before (kg/m2)	29.0±3.6###	28.9±3.7###	28.9±3.6###
BMI after (kg/m2)	28.0±3.4	28.0±3.4	28.0±3.4
WO before (cm.)	104.1±8.3###	106.9±10.7###	105.3±9.4###
WO after (cm.)	99.9±7.3	101.9±8.9	100.7±8.0

###p<0.001 vs after RH program

Tabela 6. Characteristics of aterogenic indexes

	older	younger	total
LDL/HDL before	2.5±1.0###	3.2±1.4 **###	2.8±1.2###
LDL/HDL after	1.8±0.5	2.0±0.7 *	1.9±0.6
TC/HDL before	4.6±1.4###	5.6±1.9 ***###	4.9±1.7###
TC/HDL after	3.3±0.6	3.65±0.9 **	3.4±0.8
AIP before	0.3±0.2###	0.3±0.2###	0.3±0.2###
AIP after	-0.1±0.2	-0.1±0.2	-0.1±0.2

*p<0.05; **p<0.01; *** p<0.001 between the examined groups; ###p<0.001 vs after the RH program

Discussion

The objective of cardiovascular rehabilitation is to get the patients back in the active and productive life.

In the past, elderly population, was little analysed, because older patients were excluded from randomized extensive clinical studies. Together with a trend of the growing older population, the number of studies dealing with various aspects of the ageing process, are constantly increasing. Studies, that evaluate the effects of physical training in the elderly after AMI, have showed the achievement of beneficial effects of physical training. Accordingly, the physical exercise test has been proven safe and necessary for defining the intensity of physical training, as well as, the estimation of coronary reserve in elderly coronary patients (12).

It has been established that multifactoral rehabilitation programs which include physical activity, nutritional education, counseling, psychological support and pharmacological treatment (13) have beneficial impact on the lipid level. It has also been shown that antilipaemic therapy with statines leads to stabilisation of atherosclerotic plaques (14). Today, what has definately been established is that exercise increases serum HDL-C and decreases the risk of further atherosclerotic lesion development. Recent studies suggest the benefit of the IInd phase of rehabilitation and physical training on lipid profile, physical capacity, obesity index, bihevioral characteristics and quality of life even in patients older than 75. Lavie CJ and Milani RV (15) have published the results taken from 286 patients older than 65 years of age indicating that the second phase of rehabilitation leads to the improvement of the obesity index, including total weight and BMI. Although the values of cholesterol and triglyceride were not significantly decreased, there was a significant increase of HDL cholesterol, decrease of ratio of total cholesterol/HDL and decrease of morning glucose level. Also, there was a significant increase of physical capacity and favorable influence on anxiety and depression. Our group of elderly patients did not significantly differ in the extent of obesity type. Analysis of values before and after the RH treatment showed that in both examined groups of patients and all patients on the CV rehabilitation program on the whole, a significant reduction in BMI and WV after the RH treatment occured. In both groups of our subjects, lipid parameter values (total, LDL cholesterol, and triglyceride) and morning glycemia are significantly lower after the RH program, while HDL cholesterol values showed significant increase after the RH program.

Framingam's study (16) has established that the relation of TC/HDL-C higher than 4.5 is in significant liason to coronary heart disease. Physical activity can decrease this relation and potentially reduce the risk of the future cardiovascular events in coronary patients (17). Values of most atherogenic indexes are significantly higher in younger patients in comparison to the group of older patients. Our results show that the values of all atherogenic indexes are significantly reduced after the RH program in both age groups of the examined patients and all patients on the whole. Benefitial effects of long term and regular physical training (hemodynamic, morphological, metabolic, economic, and social) are the same in both young and old cardiovascular patients. Until now, studies that have evaluated the effects of physical training in older people after MI, have showed the achievement of usefull effects, in younger patients as well (18).

Conclusion

In both groups of the examined patients on the CV rehabilitation program, statistically significant reduction in BMI and WL, correction of lipid disturbances and impaired glicoregulation occured, while HDL cholesterol values showed significant increase. Before and after the CV rehabilitation, values of most atherogenic indexes significantly decreased, but they were significantly higher in younger patients indicating the importance of CV rehabilitation especially in elderly patients.

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EFEKAT KARDIOVASKULARNE REHABILITACIJE NA STEPEN EFEKAT KARDIOVASKULARNE REHABILITACIJE NA STEPEN GOJAZNOSTI I LIPIDNE FAKTORE RIZIKA U ODNOSU NA STAROSNU DOB BOLESNIKA

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Utvrđeno je da najpovoljniji uticaj na nivo lipida imaju multifaktorijalni rehabilitacioni programi koji uključuju fizičku aktivnost, edukaciju o ishrani, savetovanje, psihološku podršku i farmakološki tretman.

Cilj rada bio je da se utvrdi efekat kardiovaskularne rehabilitacije na stepen gojaznosti i lipidne faktore rizika u zavisnosti od starosne strukture bolesnika sa preživljenim infarktom miokarda.

Ispitivanu grupu činili su bolesnici od 65 godina i stariji (n=67), prosečne starosti 72.1±3.2, a kontrolnu grupu mlađi od 65 godina (n=46), prosečne starosti 50.7±4.1 godina. Svim ispitanicima su na prijemu i otpustu urađene laboratorijske analize (glikemija, lipidni status - ukupni holesterol, HDL holesterol, LDL holesterol i trigliceridi), merenje obima struka (OS), telesne mase (TM) i indeksa telesne mase (BMI).

Grupa starijih bolesnika, u odnosu na kontrolnu grupu mlađih bolesnika, nije se značajnije razlikovala u stepenu i tipu gojaznosti. Analiza vrednosti pre i nakon rehabilitacionog tretmana pokazala je da u obe grupe ispitivanih bolesnika i ukupno kod svih bolesnika na programu kardiovaskularne (KV) rehabilitacije dolazi do značajne redukcije BMI i OS, nakon rehabilitacionog (RH) tretmana. U obe grupe naših ispitanika vrednosti lipidnih parametara (ukupnog, LDL holesterola i triglicerida) i jutarnje glikemije znatno su niže nakon sprovedenog RH programa, dok vrednosti HDL holesterola pokazuju značajni porast nakon RH programa. Vrednosti većine aterogenih indeksa bile su značajno veće kod mlađih bolesnika u odnosu na grupu starijih bolesnika.

U obe grupe ispitivanih bolesnika na programu KV rehabilitacije dolazi do statistički značajne redukcije BMI, OS, korekcije lipidnih poremećaja i glikoregulacije. Nakon rehabilitacije dolazi do redukcije vrednosti većine aterogenih indeksa ali su one bile značajno veće kod mlađih bolesnika, što ukazuje na značaj primene kardiovaskularne rehabilitacije, posebno kod starijih bolesnika. Acta *Medica Medianae 2009;48(4):17-21.*

Ključne reči: kardiovaskularna rehabilitacija, starije osobe, gojaznost, lipidni poremećaji