The Effect of 3-Weeks Stationary Cardiac Rehabilitation on Plasma Lipids Level in 444 Patients with Coronary Heart Disease

Nenad Lakušić¹, Darija Mahović², Tahir Ramqaj¹, Duško Cerovec¹, Željko Grbavac³ and Tomislav Babić²

¹ Department of Cardiology, Hospital for Medical Rehabilitation, Krapinske Toplice, Croatia
² Department of Neurology, Medical School of Zagreb, Zagreb, Croatia
³ Neurology Practice, R. Austrije 18, Zagreb, Croatia

Abstract

The aim of this study was to investigate the effect of 3-weeks stationary cardiac rehabilitation on plasma lipids level in patients with CHD. The study included 444 consecutive patients (364 male and 80 female, mean age 58±9 year) with CHD who underwent 3-weeks stationary cardiac rehabilitation. Patients were divided into groups depending on their baseline levels of cholesterol and medication therapy: patients with normal (< 5 mmol/L, group I, 129 patients) and elevate plasma level of Total cholesterol (> 5 mmol/L, group II, 315 patients) and subgroups Ia and IIa (with statin in therapy), Ib and IIb (without statin in therapy). After 3-weeks cardiac rehabilitation, the levels of Total cholesterol 5.75±1.34 vs. 5.17±1.08 mmol/L; p<0.001, triglycerides 2.04±1.33 vs. 1.81±1.06 mmol/L; p=0.004, LDL-cholesterol 3.77±1.14 vs. 3.21±0.96 mmol/L; p<0.001 were significantly lower while the level of HDL-cholesterol 0.94±0.28 vs. 0.99±0.27 mmol/L; p=0.008 were significantly higher in comparison with the baseline values. Furthermore, we found significant changes in lipid profile at the end of rehabilitation in each group of patients compared with the baseline values. There were no significant differences in plasma lipids level between group of patients with or without statin in therapy at the end of rehabilitation. The results of this study suggest that moderate regular physical activity and diet alone or in combination with hypolipidemic drugs already after 3 weeks have a favourable effect on plasma lipids level and should be propagate in the prevention of CHD.

Key words: lipids, cholesterol, triglycerides, rehabilitation, coronary heart disease

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Introduction

Coronary heart disease (CHD) has an outstanding socioeconomic character in contemporary countries because of the very high rate of morbidity and mortality. In the United States of America, about 1.5 million people per year get ill from acute myocardial infarction (MI). In the recent European Heart Survey, mortality in patients presenting with ST-elevation acute coronary syndromes was 8.4% at 1 month. Genetics factors, hyperlipidemia, hypertension, cigarette smoking, diabetes mellitus, obesity, physical inactivity and stress are the most important risk factors for CHD. Besides other treatments, many studies confirmed the importance of aggressive lowering of the plasma lipids in the primary and secondary prevention of the CHD. In recent available literature, the data about influence of combined exercise training, diet and hypolipidemic medication therapy during stationary cardiac rehabilitation on the plasma lipids level of the patients with CHD lacked.

Therefore, the aim of this study was to investigate the effect of 3-weeks stationary cardiac rehabilitation on plasma lipids level in patients with CHD.

Patients and methods

Patients eligible for this prospective study were 467 patients with CHD during 3-weeks stationary cardiac rehabilitation (mean duration 19±2 day). There were 332 (71%) patients who had myocardial infarction (MI), 117 patients (25%) who underwent coronary artery bypass grafting (CABG) and 18 patients (4%) who underwent percutaneous coronary intervention (PCI), respectively. The average body weight of the patients were 83±14 kg and average body mass index (BMI) were 27.6±3.3 (range 21.1– 36.5). Seventy-eight percent of the patients had BMI = 25 and 18% had BMI = 30, respectively. The patients were acquainted with the protocol of the study and written informed consent was obtained from the each patient.

Blood samples were taken in every patient the next day after admission and at the last day of rehabilitation. The patients were divided into the groups dependent on their baseline values of Total cholesterol and medication therapy before the start of the rehabilitation. The design of the study is present on the Figure 1. Medication during rehabilitation is present in Table 1.

Plasma Total cholesterol and triglycerides levels were determined by enzymatic colorimetric (PAP) method. LDL-cholesterol level was calculated by using Friedewald formula (LDL cholesterol (mmol/l) = Total cholesterol – triglycerides/2.2 – HDL-cholesterol) and HDL-cholesterol level was determined by using selective precipitation method with magnesium chloride.

After determination of baseline lipid profile, the patients started with rehabilitation. Rehabilitation program included conditioning on cycle ergometer, supervised group exercise and distance limited exercise walking. Rehabilitation was practiced six days a week, with resting on Sunday’s. Exercise level on cycle ergometer was determined according to the results of the symptom – limited exercise test at admission. Symptom – limited exercise test was done on cycle ergometer with initial workload of 25 W which progressive increase for 25 W each 2 minutes. In general, the intensity of daily exercise of the patients on the cycle ergometer were 70–85% of their peak heart rate achieved on the initial exercise test. The conditioning on cycle ergometer was started the next day after the initial exercise test, two times daily. On the first day, patients started conditioning with 6 one minute rounds, with one minute resting between every round. If there were no contraindications, every 3 days the number of one
A minute round were progressively increased up to a maximum number of 14. Besides conditioning on the cycle ergometer, group exercise of breathing, stretching, relaxation, muscle strengthening were done under supervision of a physiotherapist duration of 30 minutes daily. Furthermore, the distance-limited walking (1500 up to 2500 m at the end of rehabilitation) were also done daily under supervision of a physiotherapist. Diet comprised the reduction of the overall energy intake on approximately 1600 kcal per day with up to 35% unsaturated fatty acid.

Statistical analysis was performed by using the commercial software package, SPSS for Windows, Version 10.0. The results are expressed by mean values ± standard deviation and percentage of change of each plasma lipids level at the end of rehabilitation in comparison with baseline values. The differences between the groups were tested by analysis of variance with repeated measures. The va-
the value of p<0.05 was considered statistically significant.

Results

After 3-weeks cardiac rehabilitation, the levels of Total cholesterol 5.75±1.34 vs. 5.17±1.08 mmol/l; p<0.001, triglycerides 2.04±1.33 vs. 1.81±1.06 mmol/L; p=0.004, LDL-cholesterol 3.77±1.14 vs. 3.21±0.96 mmol/L; p<0.001 were significantly lower while the level of HDL-cholesterol 0.94±0.28 vs. 0.99±0.27 mmol/L; p=0.008 were significantly higher in comparison with the baseline values. We found significant changes in lipid profile at the end of rehabilitation in each group of patients compared with the baseline values (Table 2.). Furthermore, there were no significant differences in the baseline and level of plasma lipids at the end of rehabilitation between patients in the group Ia vs. Ib or IIa vs IIb, respectively.

Discussion

The results of this study clearly show that already after 3-weeks moderate regular physical activity and diet, the level of Total cholesterol, triglycerides and LDL-cholesterol significantly decreased while the level of HDL-cholesterol significantly increased. These results are in accordance with the previous studies which pointed that physical activity and diet have a favourable effect on the plasma lipids level11–14. Besides exercise and diet, by including some of the hypolipidemic drugs in the medication therapy, it could obtain a more favourable effect on the regulation of the plasma lipids level. It is interesting that we found that regular exercise improved lipid profiles similarly in patients with statin in therapy and in patients without statin. The study of Blumenthal J.A. et al. suggests that the intensity of the exercise training have no significant influence on the plasma lipids level of the CHD patients, meaning that exercise training of low intensity have a similar effect on the plasma lipids level like exercise training of high intensity15. Furthermore, Lavie C.J. et al. reported that cardiac rehabilitation have a favourable effect on the lipids profile of the very elderly CHD patients, the patients who are older than 7516. Doubtless, regular exercise training by decreasing the level of Total cholesterol, triglycerides and LDL-cholesterol and by increasing the level of HDL-cholesterol at least partially affected on reduction of the late mortality rate after MI17. Because of the effect of the exercise training and other treatment during rehabilitation, The Task Force on the Management of Acute Myocardial Infarction of the European Society of Cardiology (ESC) recommended referring cardiac rehabilitation to every patient after acute phase of MI with left ventricular dysfunction18.

During the last decade, attitude about medication hypolipidemic therapy have significantly changed. Previous opinions about hypolipidemic therapy were controversial because of the lack of the large prospective studies about the influence of
those drugs on survival after MI. The »4S« study (Scandinavian Simvastatin Survival Study) published 1994 is first and probably the most famous large prospective study which shows the importance of the aggressive lowering of the Total and LDL-cholesterol plasma level in the secondary prevention of CHD. After »4S« study, the investigators conducted and published many studies about the influence of other statins on the reduction of mortality and major coronary event rate. In general, these studies confirmed that »statin therapy« has played an important role in the prevention of CHD with the harmless of that long-term treatment 19–21. Today in clinical practice, the standard is that the patients with established CHD and elevated plasma lipid levels be treated with some dose of statin, but the prescription of that group of drugs is also recommend in the primary prevention of CHD20. Furthermore, it is important to emphasize that statins, beside lowering the level of plasma lipids, have many other anti-atherosclerotic effects named »pleiotropic« which is the additional reason for the wide prescription of those drugs22.

In conclusion, the results of this study suggest that moderate regular physical activity and diet alone or in combination with hypolipidemic drugs already after 3 weeks have a favourable effect on plasma lipids level and should be propagate in the prevention of CHD. Taking into consideration the results of this study and recommendation of the ESC18, we conclude that the majority of the patients after acute phase of MI, CABG or PCI should routinely be referred to and encouraged to attend cardiac rehabilitation programs. The ambulatory exercise and preventive programs have to be continued to preserve the beneficial effects of phase II stationary cardiac rehabilitation.

### TABLE 2

<table>
<thead>
<tr>
<th>Group of pts.</th>
<th>Cholesterol</th>
<th>Triglycerides</th>
<th>LDL-cholesterol</th>
<th>HDL-cholesterol</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>4.56±0.55</td>
<td>4.39±0.75</td>
<td>–4%</td>
<td>1.72±0.79</td>
</tr>
<tr>
<td></td>
<td>6.40±1.09</td>
<td>5.31±1.04</td>
<td>–17%</td>
<td>2.18±1.45</td>
</tr>
<tr>
<td>II</td>
<td>4.33±0.59</td>
<td>4.13±0.91</td>
<td>–5%</td>
<td>1.80±0.70</td>
</tr>
<tr>
<td>Ia</td>
<td>4.66±0.50</td>
<td>4.51±0.65</td>
<td>–3%</td>
<td>1.69±0.83</td>
</tr>
<tr>
<td>Ib</td>
<td>6.37±1.16</td>
<td>5.10±1.19</td>
<td>–20%</td>
<td>2.25±1.91</td>
</tr>
<tr>
<td>IIa</td>
<td>6.41±1.02</td>
<td>5.38±0.96</td>
<td>–16%</td>
<td>2.11±1.10</td>
</tr>
<tr>
<td>IIb</td>
<td>5.01±0.55</td>
<td>4.39±0.75</td>
<td>–4%</td>
<td>1.72±0.79</td>
</tr>
</tbody>
</table>

Acknowledgement


REFERENCES


N. Lakušić

Department of Cardiology, Hospital for Medical Rehabilitation, Krapinske Toplice, Gajeva 2, HR – 49 217 Krapinske Toplice, Croatia
e-mail: nenad.lakusic@post.htnet.hr

UTJECAJ TROTJEDNE STACIONARNE KARDIOLOŠKE REHABILITACIJE NA RAZINU LIPIDA PLAZME U 444 BOLESNIKA S KORONARNOM BOLEŠĆU

S A Ž E T A K

Normalizacija razine lipida u krvi ima važnu ulogu u prevenciji koronarnih bolesti. Cilj rada bio je utvrditi utjecaj trotjedne stacionarne kardiološke rehabilitacije na lipidogram bolesnika s koronarnom bolešću. U studiju su uključena 444 uzastopna bolesnika (364 muškarca i 80 žena) prosječne dobi 58±9 godina s koronarnom bolešću tijekom provedbe trotjedne kardiološke rehabilitacije. Ovisno o inicijalnim vrijednostima kolesterol-a i medikamentnoj terapiji kod dolaska na rehabilitaciju, bolesnici su podijeljeni u skupine: bolesnici s inicijalno normalnim (<5 mmol/L, skupina I, 29% bolesni-
ka), povišenim vrijednostima kolesterolola (>5 mmol/L, skupina II, 71% bolesnika) te podskupine Ia i IIa (uz statin u terapiji) te Ib i IIb (bez statina u terapiji). Lipidogram je određen prije početka te na kraju rehabilitacije. Rezultati su izraženi srednjom vrijednošću ± standardna devijacija te postotkom promjene razine svake pojedine frakcije lipida na kraju rehabilitacije u odnosu na inicijalne vrijednosti. U statističkoj analizi dobivenih rezultata je korištena analiza varijance s ponavljanim mjerjenjima. Nakon provedene trotjedne rehabilitacije, vrijednosti kolesterolola (5.75±1.34 vs. 5.17±1.08 mmol/L; p<0.001), triglicerida (2.04±133 vs. 1.81±106 mmol/L; p=0.004), LDL-kolesterolola (3.77±114 vs. 3.21±096 mmol/L; p<0,001) su bile značajno niže dok su vrijednosti HDL-kolesterolola (0.94±0.28 vs. 0.99±0.27 mmol/L; p=0,008) bile značajno više u odnosu na izmjerene inicijalne vrijednosti. Također, unutar svih skupina bolesnika nađene su značajne razlike u lipidogramu na kraju rehabilitacije u odnosu na inicijalne vrijednosti. Nije bilo značajne razlike u razini lipida plazme na kraju rehabilitacije između skupina bolesnika sa ili bez statina u terapiji. Rezultati ovog rada pokazuju da redoviti umjereni fizički trening i dijetna prehrana uz hipolipemičku medicamentnu terapiju već nakon tri tjedna povoljno utječu na pojedine frakcije serumskih lipida te ih treba propagirati u prevenciji koronarne bolesti.