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ARTYKUŁ ORYGINALNY / *ORIGINAL ARTICLE*

Metabolic risk in men with ischaemic heart disease and their participation in ambulatory comprehensive cardiac rehabilitation

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Abstract

Background: With a growing population of patients with ischaemic heart disease (IHD), the number of interventional cardiology and cardiac surgery procedures is also increasing. This is particularly the case for patients with multivessel coronary disease who are treated with percutaneous coronary interventions (PCI) and coronary artery bypass grafting (CABG). A considerable part of the IHD population are subjects with metabolic syndrome (MetS) who participate in comprehensive cardiac rehabilitation (CCR) programs as a part of secondary prevention of cardiovascular disease.

Aim: To evaluate prospectively conventional risk factors within MetS, including uric acid (UA) level, in men with IHD after PCI or CABG who participated in ambulatory CCR.

Methods: The study included 90 adult men (mean age 59.1 ± 7.31 years) with IHD after PCI (n = 63, 70%) or CABG (n = 27, 30%) referred for ambulatory CCR on average 30–60 days after an acute coronary syndrome. All subjects were examined twice 2 months apart — at the referral for CCR and after completion of CCR. MetS was diagnosed based on the measurement of systolic and diastolic blood pressure, waist circumference (WC), and high-density lipoprotein cholesterol, triglyceride (TG), and fasting blood glucose levels. In all subjects, UA level was also measured and the waist-to-hip ratio (WHR) and body mass index (BMI) were calculated. Following clinical evaluation and exercise test, each patient underwent 24 interval training sessions on a cycle ergometer. The patients received drug therapy including beta-blockers, angiotensin-converting enzyme inhibitors, statins, and acetylsalicylic acid. As a part of CCR, the patients also received education regarding healthy lifestyle changes including physical activity, healthy diet, stress coping techniques, effects of nicotine and alcohol, and effective methods to eliminate these habits.

Results: In most subjects, WC, BMI and WHR did not change significantly after the period of 2 months of CCR, and WC and BMI increased in the CABG subgroup ($p = 0.00003$ and $p = 0.0178$, respectively). Irrespective of the type of cardiac intervention, significant increases in exercise capacity and physical effort tolerance were observed after 2 months of CCR ($p < 0.00001$). TG level increased in all participants ($p = 0.0514$) and in the PCI subgroup ($p = 0.0489$). Systolic blood pressure decreased in all participants ($p = 0.0216$) and in the PCI subgroup ($p = 0.0043$). Mean UA level also decreased in all patients regardless of the type of cardiac intervention. Overall, the proportion of patients with the diagnosis of MetS did not change significantly after 2 months of CCR (36% vs. 31%, $p > 0.05$). However, the rate of MetS decreased in the PCI subgroup (from 46% to 29%, $p = 0.043$) and increased in the CABG subgroup (from 11% do 37%, $p = 0.0562$).

Conclusions: The effect of participation in CCR on the metabolic risk in men with IHD varies depending on the type of earlier cardiac intervention. The metabolic risk decreased in patients treated with PCI, while it increased in those treated with CABG. In order to reduce the metabolic risk, particularly in CABG patients, a CCR program requires intensification of the patient support including educational activities regarding diet and weight reduction as well as individually prescribed physical activity.

Key words: metabolic risk, metabolic syndrome, ischaemic heart disease, comprehensive cardiac rehabilitation

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INTRODUCTION

Cardiovascular disease (CVD), including ischaemic heart disease (IHD), are the major cause of mortality in industrialised countries [1]. With a growing population of patients with IHD, the number of interventional cardiology and cardiac surgery procedures is also increasing. This is particularly the case for patients with multivessel coronary disease who are treated with percutaneous coronary interventions (PCI) and coronary artery bypass grafting (CABG). A considerable part of the IHD population are subjects with metabolic syndrome (MetS) which is a heterogeneous constellation of interrelated, clinically significant factors contributing to an increased risk of the development of atherosclerosis and diabetes type 2, along with their vascular complications [2].

Patients with IHD who undergo interventional cardiology and cardiac surgery procedures are referred for comprehensive cardiac rehabilitation (CCR) programs as a part of secondary CVD prevention [3, 4]. According to the current European Society of Cardiology guidelines, patients with IHD require optimal drug therapy and education and counselling regarding healthy lifestyle. The goals of these efforts include prevention of disease progression, prolongation of life and improvement of its quality [5–7]. Most available publications do not provide information regarding the effect of CCR on the metabolic risk. In most studies, the measured outcomes of CCR in patients with IHD included the effect on cardiorespiratory fitness and exercise tolerance [8, 9]. Some studies also evaluated selected metabolic risk factors but these were mostly cross-sectional analyses at the time of patient selection for CCR [8, 10–12]. Some studies yielded discordant results, and the measured parameters were not comparable due to different study entry criteria or varying clinical characteristics of the study participants [11, 13–16].

The aim of the study was to evaluate prospectively the metabolic risk in men with IHD after PCI or CABG who participated in ambulatory CCR, with serum uric acid (UA) level measurements included along with the conventional metabolic risk factors.

METHODS

This was an observational study to evaluate the effect on metabolic risk factors in men with IHD that was achieved through an 8-week ambulatory CCR, including physical training, health education, and psychological support.

Study group

The study included consecutive men with IHD after PCI or CABG who were referred to a cardiac rehabilitation unit and accepted by a physician for CCR. Only those patients who completed the whole course of CCR, including 24 physical training sessions, and had their drug therapy unchanged were considered in the final analysis.

The study included 90 adult men (mean age 59.1 ± ± 7.31 years) with IHD after PCI (n = 63, 70%) or CABG (n = 27, 30%) referred for ambulatory CCR on average 30–60 days after an acute coronary syndrome. The inclusion criterion was the referral of a patient with IHD for CCR [4]. All subjects were examined twice 2 months apart — at the referral for CCR and after completion of CCR. Heart failure was diagnosed in 11 (12%) patients based on typical signs and symptoms and abnormalities of cardiac structure or function by echocardiography. Diabetes was found in 17 (19%) patients, hyperuricaemia (serum UA level ≥ 7 mg/dL) in 19 (21%) patients, and gout in 2 (2%) patients. No patients had coexisting cancer or chronic obstructive pulmonary disease. Atrial fibrillation was found in 1 (1%) patient.

For the purpose of the main study analysis, the diagnostic criteria for MetS in European men were based on the 2009 guidelines [2]. These recommendations are consistent with the modified threshold values of the diagnostic criteria for MetS suggested by the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) [17]. MetS was defined as the presence of at least 3 of 5 established, clinically significant cardiometabolic risk factors for the European population, including fasting blood glucose ≥ 100 mg/dL, waist circumference (WC) in men > 94 cm, systolic blood pressure (SBP) ≥ 130 mm Hg or diastolic blood pressure (DBP) ≥ 85 mm Hg, triglyceride (TG) level > 150 mg/dL, and high-density lipoprotein cholesterol (HDL-C) in men < 40 mg/dL [2]. Serum UA level, which a prognostic risk factor for CVD, was measured in all subjects [18, 19]. All biochemical parameters including fasting glucose, HDL-C, TG, and UA were measured by the colorimetric method using Cormay kits. In all subjects, basic anthropometric measurements were performed twice including height (cm), body weight (kg), WC (cm), and hip circumference (cm). Based on these parameters, the waist-to-hip ratio (WHR) and body mass index (BMI, kg/m^2) were calculated.

Exercise test

To plan the individual intensity of kinesiotherapy within CCR, a symptom limited exercise test was performed in all participants using an Ergomedic 828E cycle ergometer (Monark) and the Stress Test Medea 2000 program, with gradually increased workload, usually starting at 30 W or 60 W with 30 W to 60 W increments every 2–3 min. A 12-lead electrocardiogram (ECG) was monitored on-line and blood pressure (BP) was measured at the end of each workload. The parameters of exercise capacity and physical effort tolerance included the peak workload that was well tolerated (Ppeak, W) and the peak heart rate at this workload (HRpeak, bpm). In all participants, the criteria for exercise test termination included reaching 85% of the maximum heart rate (HRmax) and symptoms necessitating termination of the test.

Physical training

Workload during physical training was planned individually using the formula: on-training HRpeak = resting HR + 60–80%

of the heart rate reserve (HRR) [20]. An additional criterion for the intensity of the aerobic training was the rating of perceived exertion of 11–13 in the Borg scale during initial sessions, increasing up to 14–16 during later training. The mean duration of exercise during a single training session was 40 min. Interval trainings (IT) performed on Ergoselect II 100/200 cycle ergometers (Ergoline Reha System GmbH) were characterised by a varying load (load increase during the first part of the training and decrease during the second part of the training) during 4 min of exercise separated by 2-min periods of active restitution. During CCR, all patients were also instructed to engage in general conditioning exercises for 10–15 min twice daily, with their intensity resulting in HR increase by no more than 30% of the resting HR. The IT program included 24 sessions performed three times a week, monitored by on-line ECG and BP measurements before and after the session and at the end of each workload peak.

All patients received drug therapy including beta-blockers, angiotensin-converting enzyme inhibitors (ACEI), statins, and acetylsalicylic acid (ASA) (94% to 100% patients, Table 1). Fibrate was used in 1 (1%) participant. Among 17 (19%) patients with diabetes, 13 (14%) were treated with oral antidiabetic medications and 4 (4%) were treated with insulin. Any changes in drug treatment during ambulatory CCR were an exclusion criterion.

As a part of CCR, the patients also participated in educational sessions regarding healthy lifestyle changes including physical activity, healthy diet, stress coping techniques, effects of nicotine and alcohol, and effective methods to eliminate these habits.

The study was approved by the Bioethics Committee at the Medical University of Łódź (approval No. RNN/551/10/KB of Sep 07, 2010).

Statistical methods

Dependent variables and the obtained results were subjected to a statistical analysis using the Statistica for Windows 10.0 software. Normal distribution of the variables was verified using the Shapiro-Wilk test. Mean values and standard deviations were calculated. The Mann-Whitney U test was used to compare the mean values between independent samples, and the two-sample paired Wilcoxon test was used for dependent samples. The McNemar's test was used to verify the rates of MetS thresholds at the two stages during the study. $P < 0.05$ was considered statistically significant.

RESULTS

Clinical characteristics of men with IHD subjected to CCR are shown in Table 1. Most subjects (46%) suffered from a ST segment elevation myocardial infarction. Non-ST segment elevation myocardial infarction and acute coronary syndrome without infarction occurred in 27% and 28% of patients, respectively. Most patients received ASA (96%), ACEI (97%), statins (94%), and beta-blockers (100%). Subgroups of patients after PCI or CABG did not differ in regard to the clinical characteristics shown in Table 1. At the time of the evaluation before CCR, participants were characterised by overweight regardless of the type of cardiac intervention (PCI vs. BMI). After 2 months of CCR, BMI did not decrease in most participants, and even increased in the CABG group ($p = 0.00003$). Irrespective of the type of cardiac intervention, significant increases in exercise capacity and physical effort tolerance were observed after 2 months of CCR ($p < 0.00001$).

Table 2 shows the results of the evaluation of MetS components, including UA level, in men with IHD who underwent CCR. After 2 months of CCR, TG level increased in all participants ($p = 0.0514$) and in the PCI subgroup ($p = 0.0489$). SBP decreased significantly in all participants ($p = 0.0216$) and in the PCI subgroup ($p = 0.0043$). Mean UA level also decreased in all patients regardless of the type of cardiac intervention.

The rates of MetS diagnostic criteria in the study group are shown in Table 3. The rates of these criteria did not change after 2 months of CCR except for BP > 130/85 mm Hg which was noted in fewer subjects, particularly in the PCI group ($p = 0.0022$).

A detailed analysis of the number of MetS diagnostic criteria men with IHD who underwent CCR is shown in Table 4. Initially, MetS was present in 36% of subjects, and after 2 months of CCR this proportion was reduced to 31% ($p > 0.05$). However, the rate of MetS decreased in the PCI subgroup (from 46% to 29%, $p = 0.043$) and showed an increase of borderline significance in the CABG subgroup (from 11% do 37%, $p = 0.0562$). Among all subjects with the diagnosis of MetS at the time of the evaluation before CCR ($n = 32$, 36%), 16 (18%) patients showed a lower number of MetS diagnostic criteria after 2 months of CCR, and the criteria of MetS were not met anymore in 4 (4%) men. Opposite trends were seen in patients without MetS ($n = 58$, 64%), with a higher number of MetS diagnostic criteria noted in 25 (28%) subjects. After 2 months of CCR, the rate of MetS increased by 7.8% among CABG patients in whom the criteria of MetS were not met at the time of the initial evaluation.

DISCUSSION

In our study, we characterised the effect of ambulatory CCR on the metabolic risk in men in relation to the previous cardiac intervention (PCI or CABG). This effect was shown to be limited, and in many aspects even adverse in regard to further progression of the underlying disease and concomitant conditions, particularly in men after CABG. Our findings provided important information indicating the need for intensification of the CCR program to improve MetS risk profile.

In patients after PCI or CABG, CCR should be conducted according to the established criteria [3, 4]. Main goals include improvement of exercise capacity, beneficial modification of CVD risk factors, and preventing new atherosclerotic events.

Table 1. Clinical characteristics of men with ischaemic heart disease participating in comprehensive cardiac rehabilitation (n = 90)

Parameter	Overall (n= 90)				PCI (n= 63)				CABG (n = 27)				P: PCI vs. CABG	
	1st assessment	2nd assessment	Δ	P	1st assessment	2nd assessment	Δ	P	1st assessment	2nd assessment	Δ	P	1st assessment	2nd assessment
Age [years]	55 ± 7.31	55 ± 7.31	0	NS	58.35 ± 7.32	58.35 ± 7.32	0	NS	61.23 ± 6.37	61.23 ± 6.37	0	NS	NS	
Body weight [kg]	86.78 ± 15.49	87.7 ± 15.33	0.92	NS	88.35 ± 16.3	89.11 ± 16.19	0.76	NS	82.5 ± 12.82	84.44 ± 12.89	1.94	NS	NS	NS
Height [cm]	171.54 ± 13.86	171.54 ± 13.86	0	NS	171.39 ± 15.86	171.39 ± 15.86	0	NS	171.66 ± 7.09	171.66 ± 7.09	0	NS	NS	
BMI [kg/m^2]	28.96 ± 4.40	29.27 ± 4.34	0.31	NS	29.32 ± 4.57	29.54 ± 4.57	0.22	NS	27.97 ± 3.87	28.68 ± 3.76	0.71	0.0003	NS	NS
WHR	1.0 ± 0.06	1 ± 0.06	0	NS	1 ± 0.062	1 ± 0.06	0	NS	1 ± 0.05	1 ± 0.046	0	NS	NS	NS
Resting HR [bpm]	68.25 ± 9.24	66.02 ± 9.05	–2.23	NS	66.87 ± 8.55	65.56 ± 8.93	–1.31	NS	71.93 ± 10.1	67.07 ± 9.4	–4.86	NS	0,04787	NS
Ppeak [W]	91.35 ± 17.46	117.98 ± 18.54	26.63	< 0.0001	94.21 ± 16.94	119.97 ± 19.43	25.76	< 0.0001	83.33 ± 15.2	113.33 ± 15.2	30	< 0.0001	< 0.0001	NS
HRpeak [bpm]	108.31 ±12.73	112.9 ± 12.39	4.59	NS	108.25 ± 13.36	119.97 ± 19.43	11.72	≤ 0.05	108.81 ± 11.23	114.44 ± 9.81	5.63	NS	NS	NS
	n (%)	n (%)	p		n (%)	n (%)	p		n (%)	n (%)	p			
NSTEMI	24 (27)	24 (27)	NS		20 (32)	20 (32)	NS		4 (15)	4 (15)	NS			
STEMI	41 (46)	41 (46)	NS		32 (51)	32 (51)	NS		9 (33)	9 (33)	NS			
ACS without infarction	25 (28)	25 (28)	NS		11 (17)	12 (17)	NS		14 (52)	14 (52)	NS			
ASA	86 (96)	86 (96)	NS		59 (94)	59 (94)	NS		27 (100)	27 (100)	NS			
Statin	85 (94)	85 (94)	NS		59 (94)	59 (94)	NS		26 (96)	26 (96)	NS			
ACEI	87 (97)	87 (97)	NS		61 (97)	61 (97)	NS		26 (96)	26 (96)	NS			
Beta-blockers	90 (100)	90 (100)	NS		63 (100)	63 (100)	NS		27 (100)	27 (100)	NS			

PCI — percutaneous coronary intervention; CABG — coronary artery bypass grafting; BMI — body mass index; WHI — waist-to-hip ratio; HR — heart rate; Ppeak — peak workload that was well tolerated; HRpeak — HR at Ppeak; NSTEMI — non- segment elevation myocardial infarction; STEMI — ST segment elevation myocardial infarction; ACS — acute coronary syndrome; ASA — acetylsalicylic acid; ACEI — angiotensin-converting enzyme inhibitor

Table 2. Values of metabolic syndrome criteria and uric acid level in men with ischaemic heart disease participating in comprehensive cardiac rehabilitation (n = 90)

Metabolic criterion	Overall (n = 90)			PCI (n = 63)			CABG (n = 27)			P: PCI vs. CABG	
	1st assessment	2nd assessment	P	1st assessment	2nd assessment	P	1st assessment	2nd assessment	P	1st assessment	2nd assessment
Waist circumference [cm]	104.2 ± 11.17	104.86 ± 10.62	NS	105.25 ± 12	105.33 ± 11.5	NS	102.15 ± 8.77	103.81 ± 1.42	0.0178	NS	NS
Triglycerides [mg/dL]	120.10 ± 55.15	140.83 ± 50.9	0.0514	121.87 ± 63.0	141.75 ± 52.25	0.0489	115.96 ± 50.19	138.7 ± 57.89	NS	NS	NS
HDL [mg/dL]	46.25 ± 11.46	46.47 ± 12.15	NS	46.56 ± 12.25	45.89 ± 11.99	NS	45.4 ± 9.57	47.96 ± 12.65	NS	NS	NS
SBP [mm Hg]	129.50 ± 15.47	124.39 ± 17.78	0.0216	130.56 ± 15.81	123.26 ± 17.23	0.0043	127.04 ± 14.63	127.034 ± 19.08	NS	NS	NS
DBP [mm Hg]	81.06 ± 11.37	79.16 ± 8.40	NS	81.21 ± 10.81	78.79 ± 8.28	NS	80.74 ± 12.76	80 ± 8.77	NS	NS	NS
Fasting glucose [mg/dL]	104.6 ± 33.04	103.27 ± 36.37	NS	108.37 ± 35.03	105.03 ± 40.23	NS	95.81 ± 26.37	99.08 ± 24.91	NS	NS	NS
Uric acid [mg/dL]	6.14 ± 1.22	5.85 ± 1.30	0.0038	6.08 ± 1.1	5.86 ± 1.19	0.0274	6.29 ± 1.48	5.82 ± 1.56	0.0487	NS	NS

PCI — percutaneous coronary intervention; CABG — coronary artery bypass grafting; HDL — high-density lipoprotein; SBP — systolic blood pressure; DBP — diastolic blood pressure

Table 3. Rates of metabolic syndrome criteria in men with ischaemic heart disease participating in comprehensive cardiac rehabilitation (n = 90)

Metabolic syndrome	Overall (n = 90)					PCI (n = 63)					CABG (n = 27)					P: PCI vs. CABG	
	1st assessment		2nd assessment		p	1st assessment		2nd assessment		p	1st assessment		2nd assessment		p	1st assessment	2nd assessment
	n	%	n	%		n	%	n	%		n	%	n	%			
Waist circumference > 94 cm	73	81	78	87	NS	53	84	51	81	NS	20	74	27	100	NS	NS	0.0359
Triglycerides > 150 mg/dL	17	19	21	23	NS	14	22	16	25	NS	3	11	5	19	NS	NS	NS
HDL < 40 mg/dL	25	28	26	29	NS	18	29	18	29	NS	7	26	8	30	NS	NS	NS
Blood pressure > 130/85 mm Hg	37	41	24	27	0.0311	29	46	13	21	0.0022	8	30	11	41	NS	NS	0.0481
Fasting glucose > 100 mg/dL	38	42	32	36	NS	30	48	22	35	NS	8	30	10	37	NS	NS	NS

PCI — percutaneous coronary intervention; CABG — coronary artery bypass grafting; HDL — high-density lipoprotein

Table 4. The number of metabolic syndrome criteria in men with ischaemic heart disease participating in comprehensive cardiac rehabilitation (n = 90)

No. of metabolic syndrome criteria	Overall (n = 90)					PCI (n = 63)					CABG (n = 27)					P: PCI vs. CABG	
	1st assessment		2nd assessment		p	1st assessment		2nd assessment		p	1st assessment		2nd assessment		p	1st assessment	2nd assessment
	n	%	n	%		n	%	n	%		n	%	n	%			
0	6	7	6	7	NS	3	5	6	10	NS	3	11	0	0	NS	NS	NS
1	21	23	25	28	NS	15	24	19	30	NS	6	22	6	22	NS	NS	NS
2	31	34	31	34	NS	16	25	20	32	NS	13	56	11	41	NS	0.0343	NS
3	23	26	18	20	NS	21	33	11	17	0.040	2	7	7	26	NS	0.0203	NS
4	7	08	10	11	NS	6	10	7	11	NS	1	4	3	11	NS	NS	NS
5	2	02	0	0	NS	2	3	0	0	NS	0	0	0	0	NS	NS	NS
Overall ≥ 3 criteria	32	36	28	31	NS	29	46	18	29	0.042731	3	11	10	37	0.056170	0.003376	NS

PCI — percutaneous coronary intervention; CABG — coronary artery bypass grafting

A well established and documented cardiometabolic parameter is WC which shows strong correlations with abdominal fat, TG, HDL-C, and fasting glucose levels, and BP [21, 22]. A metaanalysis by Pattyn et al. [13] suggested that dynamic endurance training in subjects with MetS is associated with beneficial effect on most cardiovascular risk factors associated with MetS, i.e. WC, HDL-C level, SBP, and DBP. A reduction in WC was noted by mean 3.4 cm during at least 4 weeks. The results of the metaanalysis show that participation in dynamic endurance training has a significant effect on other established CVD risk factors, i.e. low-density lipoprotein cholersterol level, total cholesterol level, BMI, and VO_2peak [14]. In contrast, TG and fasting glucose levels remained unchanged after CCR compared to initial values [14]. In our study, regardless of the type of cardiac intervention in men with IHD, abdominal obesity was noted after 2 months of CCR, defined as WC > 94 cm [2]. In all groups of men referred for CCR, a reduction in body weight was noted at the second anthropometric measurements following completion of a CCR program. The improvement in WC is not always optimal and sustained. It has been suggested that the reduction in body weight might result from previous admission to an interventional cardiology or cardiac surgery unit that led to referral for CCR. Lower body weight at the time of the evaluation before CCR may be related to the hospital diet or modification of previous drug therapy after CABG. Lack of body weight reduction is considered a poor outcome of CCR, particularly if the participants were overweight and/or obese [23].

In context of the above described relations between the components of MetS, it should be noted that in our study, TG level increased in all men, regardless of the type of cardiac intervention. Available prospective analyses in the European populations showed moderately or highly significant relations between TG level and CVD risk [24]. Identification of a borderline high TG level indicates the need for lifestyle modification in regard to those unhealthy behaviours which predispose to secondary hypertriglyceridaemia, e.g. unhealthy diet including high caloric intake contributing to overweight and obesity, low physical activity, smoking, excessive alcohol consumption, and diabetes [25]. In light of these observations, interventional cardiology and cardiac surgery procedures should lead to effective, widely available and comprehensive secondary prevention of CVD combined with a management strategy which involves health education regarding various aspects of IHD, undertaken before, during, and after the procedure-related hospitalisation. In the long term, intensive efforts to reduce these adverse health behaviours, undertaken within the CCR program after PCI or CABG, may significantly reduce the number of future interventional cardiology and cardiac surgery procedures, recurrent myocardial infarction rate, and mortality due to CVD [14, 15].

Regarding the presence of MetS, its rate among CVD patients undergoing CCR is increased twice compared to the general population [10]. In our study, the rate of MetS was reduced in the overall study population and in the PCI subgroup during the second evaluation compared to the first one. However, an adverse trend in regard to the rate of MetS was noted among men with IHD who were treated with CABG.

Available literature regarding cardiorespiratory fitness parameters indicates that a rapid improvement in the cardiovascular risk profile, exercise capacity, and the quality of life is seen in subjects with MetS who participate in CCR programs based on individually adjusted physical training with varying type, duration, and intensity of exercise [2, 10, 15]. Also in our study, we found that physical training which was the basis of the CCR program resulted in measurable benefits in regard to the analysed parameters of physical effort tolerance, i.e. Ppeak (regardless of the type of cardiac intervention) and HRpeak during the training (particularly among men after PCI). Similar beneficial changes of physical effort tolerance were noted by other authors in patients after a myocardial infarction treated with angioplasty of the culprit vessel, PCI, and CABG [12, 16, 17].

It was shown that participation in a CCR program after PCI is associated with a significant reduction of all-cause mortality [16]. Even in low-risk patients, a CCR program is an important factor that improves outcomes of angioplasty or stenting [10, 13]. A significant effect of early CCR on the improvement of the quality of life and mortality reduction in patients after CABG has also been highlighted [16]. Although most opinions on CCR are favourable, some critical views have also been expressed, with authors reporting little positive effects of these programs [17]. In light of some opinions, subjects with CVD are at risk of further deterioration of cardiometabolic parameters following completion of a CCR program [11, 12]. Extending CCR and/or monitoring the patient status following completion of a CCR program proved to be an intervention that results in long-term improvement of the quality of life [16].

CONCLUSIONS

Among men with IHD after PCI or CABG who participated in a CCR program, the criteria of MetS were initially met in 36% of patients, and this rate decreased to 31% following CCR, a non-significant difference. We showed that the effect of participation in a CCR program on the metabolic risk varied depending on the type of earlier cardiac intervention. The metabolic risk decreased significantly in patients treated with PCI, while the rate of MetS increased among patients who underwent CABG. In order to reduce the metabolic risk, particularly in CABG patients, a CCR program requires intensification of the therapy with educational activities regarding individually prescribed regular physical activity as well as diet and weight reduction.

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Ryzyko metaboliczne u mężczyzn z chorobą niedokrwienną serca a uczestnictwo w ambulatoryjnej kompleksowej rehabilitacji kardiologicznej

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Streszczenie

Wstęp: Ustawicznie zwiększającej się populacji osób z chorobą niedokrwienną serca (IHD) towarzyszy progresja liczby zabiegów z zakresu kardiologii interwencyjnej i zabiegów kardiochirurgicznych. W szczególności dotyczy to osób z wielonaczyniową postacią choroby wieńcowej po protezowaniu naczyń wieńcowych (PCI) i po wszczepieniu pomostów aortalno-wieńcowych (CABG). Duży odsetek pacjentów z IHD stanowią osoby z zespołem metabolicznym (MetS) biorące udział w programie kompleksowej rehabilitacji kardiologicznej (CCR) obejmującej wielopłaszczyznowe działania interwencyjne wchodzące w skład prewencji wtórnej chorób sercowo-naczyniowych.

Cel: Celem badania była prospektywna obserwacja klasycznych wskaźników składających się na MetS poszerzona o stężenie kwasu moczowego (UA), u mężczyzn z IHD po PCI lub po CABG poddawanych ambulatoryjnej CCR.

Metody: Badaniem objęto 90 dorosłych mężczyzn (średnia wieku 59,1 ± 7,31 roku) z IHD zakwalifikowanych do programu ambulatoryjnej CCR. W obserwacji uczestniczyło 63 (70%) mężczyzn po PCI i 27 (30%) mężczyzn po CABG, średnio 30–60 dni po ostrym incydencie sercowym. Wszyscy uczestnicy byli badani 2-krotnie w odstępie 2 miesięcy — w czasie kwalifikacji i po ukończeniu programu. MetS zdiagnozowano, oceniając skurczowe (SBP) i rozkurczowe ciśnienie tętnicze, obwód talii (WC) oraz stężenia cholesterolu frakcji HDL, triglicerydów (TG) i glukozy na czczo. U wszystkich uczestników określono również stężenie UA, wyliczono wskaźnik talia-biodra (WHR) i wskaźnik masy ciała (BMI). Po kwalifikacji klinicznej i próbie wysiłkowej u każdego z badanych mężczyzn przeprowadzono 24 treningi interwałowe na ergometrze rowerowym. Chorzy przyjmowali w tym samym czasie środki farmakologiczne, głównie: beta-adrenolityki, inhibitory konwertazy angiotensyny, statyny i kwas acetylosalicylowy. Istotny element programu CCR stanowiła edukacja zdrowotna uczestników dotycząca prozdrowotnej modyfikacji stylu życia, z uwzględnieniem aktywności fizycznej, racjonalnego żywienia, technik radzenia sobie ze stresem, wpływu nikotyny i alkoholu na organizm człowieka oraz metod wykorzystywanych do skutecznej walki z tymi uzależnieniami.

Wyniki: Po okresie 2-miesięcznej CCR wartości WC, BMI i WHR nie uległy istotnej redukcji u większości badanych mężczyzn, a w podgrupie poddanej CABG odnotowano zwiększenie WC i BMI (odpowiednio $p = 0,00003$ i $p = 0,0178$). Bez względu na rodzaj zastosowanej interwencji kardiologicznej zaobserwowano istotny wzrost wydolności fizycznej i poprawę tolerancji wysiłku fizycznego po 2-miesięcznej CCR ($p < 0,00001$). Po tym czasie zanotowano wzrost stężenia TG u wszystkich badanych ($p = 0,0514$) oraz w podgrupie poddanej PCI ($p = 0,0489$). Analiza wartości SBP dostarczyła informacji o istotnym obniżeniu tego parametru po 2-miesięcznej CCR wśród wszystkich badanych ($p = 0,0216$). Podobny kierunek zmian w zakresie SBP odnotowano w podgrupie poddanej PCI ($p = 0,0043$). Bez względu na charakter zastosowanej interwencji kardiologicznej zaobserwowano istotne statystycznie obniżenie średniego stężenia UA u wszystkich badanych mężczyzn. W wyniku stosowania 2-miesięcznej CCR częstość diagnozy MetS w całej badanej grupie nie uległa istotnej statystycznie zmianie (36% *vs*. 31%; $p > 0,05$). Natomiast w podgrupie poddanej PCI stwierdzono znamienną redukcję liczby rozpoznań MetS (46% *vs*. 29%; $p = 0,043$), a w podgrupie po CABG wzrost liczby rozpoznań MetS (11% *vs*. 37%, $p = 0,0562$).

Wnioski: Wpływ udziału w CCR na ryzyko metaboliczne u mężczyzn z IHD jest rożny i zależny od wcześniej zastosowanej interwencji kardiologicznej. U mężczyzn po PCI ryzyko metaboliczne obniżyło się, a u mężczyzn po CABG ryzyko to wzrosło. W celu zmniejszenia ryzyka metabolicznego, zwłaszcza wśród mężczyzn po CABG, program CCR wymaga zintensyfikowania wsparcia działaniami edukacyjnymi dotyczącymi sposobu żywienia i redukcji masy ciała oraz regularnej, indywidualnie zalecanej aktywności fizycznej.

Słowa kluczowe: ryzyko metaboliczne, zespół metaboliczny, choroba niedokrwienna serca, kompleksowa rehabilitacja kardiologiczna

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