

Association between physical exercise and quality of erection in men with ischaemic heart disease and erectile dysfunction subjected to physical training

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Abstract

Background: In addition to a beneficial effect on exercise tolerance and an associated reduction of global cardiovascular risk, modification of physical activity has a positive effect on the quality of life, reducing, among other things, the severity of erectile dysfunction (ED).

Aim: The specific nature of sexual activity, which combines the need to maintain appropriate exercise tolerance and good erection quality, prompted us to evaluate the association between exercise tolerance and severity of ED in an intervention group of subjects with ischaemic heart disease (IHD) and ED in the context of cardiac rehabilitation (CR).

Methods: A total of 138 men treated invasively for IHD (including 99 treated with percutaneous coronary intervention and 39 treated with coronary artery bypass grafting) who scored 21 or less in the initial IIEF-5 test were investigated. Subjects were randomised into two groups. The study group included 103 subjects (mean age 62.07 ± 8.59 years) who were subjected to a CR cycle. The control group included 35 subjects (mean age 61.43 ± 8.81 years) who were not subjected to any CR. All subjects filled out an initial and final IIEF-5 questionnaire and were evaluated twice with a treadmill exercise test. The CR cycle was carried out for a period of 6 months and included interval endurance training on a cycle ergometer (three times a week) and general fitness exercises and resistance training (twice a week).

Results: The CR cycle in the study group resulted in a statistically significant increase in exercise tolerance (7.15 ± 1.69 vs. 9.16 ± 1.84 METs, $p < 0.05$) and an increase in erection quality (12.51 ± 5.98 vs. 14.39 ± 6.82 , $p < 0.05$) which was not observed in the control group. A significant effect of age on a progressive decrease in exercise tolerance and erection quality was found in the study group. Exercise tolerance and erection quality were also negatively affected by hypertension and smoking. A significant correlation between exercise tolerance and erection quality prior to the rehabilitation cycle indicates better erection quality in patients with better effort tolerance. The improvement in exercise tolerance did not correlate significantly with initial exercise tolerance or age of the subjects. In contrast, a significantly higher increase in erection quality was observed in younger subjects with the lowest baseline severity of ED. The relative increase in exercise tolerance in the group subjected to CR was significantly higher than the relative increase in erection quality but these two effects were not significantly correlated with each other.

Conclusions: 1. In subjects with IHD and ED, erection quality is significantly correlated with exercise tolerance. 2. Exercise training had a positive effect on both exercise tolerance and erection quality but the size of these two effects was different and they ran independently of each other.

Key words: cardiac rehabilitation, erectile dysfunction, exercise tolerance, IIEF-5 questionnaire

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INTRODUCTION

In the stereotypical literary image of a “real man”, predominant features include high physical and sexual fitness. Numerous observations confirmed that the common denominator of these two attributes of masculinity is healthy physical activity. Low level of physical activity in association with other risk factors is thought to play a major role in the development of erectile dysfunction (ED), and potential simplicity of a lifestyle modification to increase physical activity has resulted in a growing interest in this form of therapy [1, 2]. Exercise therapy in patients with ischaemic heart disease (IHD) is an element of prevention programs and a fundamental component of cardiac rehabilitation (CR) which was shown to have a beneficial effect on exercise tolerance and modifiable risk factors for cardiovascular disease (CVD) [3]. It results in delayed progression and decreased intensity of the inflammatory atherosclerotic process, and these effects are not limited to coronary vessels but affect the whole arterial system, including those arteries in which endothelial dysfunction and atherosclerotic changes are one of the key factors contributing to the development of ED [4, 5]. Although penile erection depends on adequate neural and vascular activity, adequate exercise tolerance is also necessary for satisfactory sexual activity. It is thus of interest what is the effect of exercise tolerance in patients with IHD and ED on the quality of erection, and how CR modifies exercise tolerance and erection quality.

METHODS

Study group

We investigated 138 men treated invasively for IHD (including 99 patients treated with percutaneous coronary intervention and 39 patients treated with coronary artery bypass grafting) who scored 21 or less in the initial International Index of Erectile Function-5 (IIEF-5) test. Subjects were randomised into two groups. The study group included 103 patients, who were subjected to a CR cycle, and the control group included 35 subjects who were not subjected to any CR (Table 1). Exclusion criteria are shown in Table 2. Neurological and orthopaedic conditions present in the investigated patients had no significant adverse effect on motor function and possibility to use kinesiotherapy. In the study group, patients were included in the analysis if their actual participation in the CR cycle was at least 90%.

All patients in the study and control groups received drug therapy in accordance to the current standard of IHD therapy. A need to modify dosage of drugs with an established negative effect on erection during 6-month follow-up in the study was an exclusion criterion. No patient had malignant ventricular arrhythmia or significant conduction disturbances in 24-h ambulatory electrocardiography.

Exercise training

Exercise training cycle was carried out for a period of 6 months and included interval endurance training on a cycle ergometer,

indoor or outdoor general fitness exercises, and resistance training. CR training sessions were performed 5 days a week, with alternate sessions of general fitness exercises and resistance training (2 days a week) and interval endurance training on a Ergoline ER900 ergometer (Ergoline GmbH, Bitz, Germany) (3 days a week). During a single 45-min training session, exercise intensity of 4-min cycling intervals gradually increased during the first half of the training and then decreased after reaching peak intensity, with cycling sessions intertwined with 2-min resting periods of continuing load of 0–5 W. The training session was preceded by a 2 min warm-up and concluded with a 3-min cool-down with no workload. Peak exercise intensity was initially set at 40–70% of the workload during the initial exercise test, and then increased by no more than 10 W for each interval every 12 endurance training sessions on a cycle ergometer, provided that patient adaptation to exercise was considered normal (based on subjective assessment and decreasing rise in heart rate at peak exercise). During training sessions on a cycle ergometer, continuous heart rate monitoring was performed with automatic blood pressure measurements at the beginning and end of each interval. General fitness exercises included group breathing exercises along with relaxing, stretching, balance, and agility exercises. Indoor training was coupled with elements of endurance training that included 8–10 types of endurance exercises involving various muscle groups. All exercises were performed in series of 12–15 repetitions. All patients performed the same sets of exercise. During training, perceived exertion at the level 13 on 15-grade Borg scale was not exceeded. CR was performed in accordance with the Polish Cardiac Society Recommendations [6].

The control group which was not subjected to CR received general health information on the need for healthy lifestyle, including individualised recommendations regarding the type, intensity, and desired amount of healthy physical activity.

Exercise electrocardiography

Electrocardiographic exercise test was performed in accordance with the Polish Cardiac Society Recommendations [6] using treadmill (Challenger, USA; ECG Cardio system for exercise testing, Perfekt MD Rozinn Electronics, New York, USA) in a well ventilated room and in appropriate temperature conditions. Exercise tests were performed in morning hours after night-time bed rest, and patients were advised to avoid strenuous exercise, strong emotions, and the use of stimulants before testing. All patients had previous experiences with exercise testing. The modified Bruce protocol was used, and stress test was symptom-limited. All patients reached at least 70% of the maximum heart rate, and reason for terminating the test was subjective exhaustion rendering further exercise impossible. Patient monitoring after termination of exercise was continued until exhaustion resolved and patient declared the ability to leave the exercise testing laboratory. In all patients, exercise testing was performed twice, including before

Table 1. Clinical characteristics of patients with ischaemic heart disease and erectile dysfunction in the study and control groups

Variable	Study group	Control group	P
Number of patients	103	35	–
Age [years]	62.07 ± 8.63	61.43 ± 8.81	0.707
Body mass index [kg/m ²]	28.99 ± 4.71	27.08 ± 2.43	0.023
Previous myocardial infarction	70 (67.83%)	19 (54.29%)	0.209
Haemoglobin [g/dL]	14.40 ± 0.89	14.60 ± 0.78	0.228
eGFR (MDRD formula)	77.64 ± 11.04	81.03 ± 11.90	0.125
Total cholesterol [mg/dL]	212.88 ± 46.67	214.60 ± 40.51	0.846
Triglycerides [mg/dL]	178.49 ± 107.73	169.07 ± 76.31	0.636
Number and percentage of patients in specific categories of erectile dysfunction severity:			
Mild (17–21 points)	30 (29.13%)	9 (25.71%)	0.865
Moderate (12–16 points)	32 (31.07%)	11 (31.43%)	0.863
Moderately severe (8–11 points)	10 (9.71%)	4 (11.43%)	0.973
Severe (0–7 points)	31 (30.13%)	11 (31.43%)	0.948
Echocardiographic parameters:			
LVEDD [mm]	52.28 ± 5.86	55.49 ± 3.67	0.003
Ejection fraction [%]	56.89 ± 7.67	54.97 ± 7.08	0.197
Left atrial dimension [mm]	37.45 ± 3.89	38.66 ± 3.44	0.106
RVEDD [mm]	22.73 ± 2.91	24.31 ± 1.92	0.003
Invasive treatment:			
PTCA	72 (69.90%)	27 (77.14%)	0.545
CABG	31 (30.10%)	8 (22.86%)	0.545
Drug treatment:			
Beta-blocker	99 (96.12%)	33 (94.29%)	0.643
ACEI and/or ARB	70 (67.96%)	28 (80.00%)	0.254
Lipid-lowering drug	95 (92.23%)	28 (80.00%)	0.090
Diuretic	24 (23.30%)	6 (17.14%)	0.599
Cardiovascular disease risk factors:			
Hypertension	61 (59.22%)	26 (74.29%)	0.163
Diabetes type 2	22 (21.36%)	9 (25.71%)	0.765
Lipid abnormalities	67 (65.05%)	22 (62.86%)	0.976
Smoking	61 (59.22%)	20 (57.14%)	0.986
Body mass index >25 kg/m ²	76 (73.79%)	22 (62.86%)	0.398
Inappropriately low healthy physical activity*	101 (98.06%)	35 (100.00%)	0.999

* < 1000 kcal/week; eGFR — estimated glomerular filtration rate; MDRD — Modification of Diet in Renal Disease; LVEDD — left ventricular end-diastolic dimension; RVEDD — right ventricular end-diastolic dimension; PCI — percutaneous coronary intervention; CABG — coronary artery bypass grafting; ACEI — angiotensin-converting enzyme inhibitor; ARB — angiotensin receptor blocker

and after the CR cycle in the study group, and with a similar 6-month interval in the control group. We evaluated exercise tolerance observed during the initial (ExT1) and the final (ExT2) test, defined in metabolic equivalents (METs), and we also calculated the difference between ExT2 and ExT1 (Δ ExT).

Assessment of erection quality

Erection quality was assessed using the IIEF-5 questionnaire that includes 4 questions with answers scoring 0–5 for a total

score of 0–25. ED was diagnosed if the total score was 21 or less. Only intercourses that were not preceded by administration of a phosphodiesterase type 5 inhibitor were taken into account for the purpose of this evaluation. All subjects were in a stable long-term relationship with the same sexual partner. In none of the patient, sexual activity during the preceding month did not induce angina. Among patients subjected to CR, the IIEF-5 questionnaire was administered twice, before and after the CR cycle. In the control group,

Table 2. Exclusion criteria

Penile anatomical changes
Urological disease: prostatic hyperplasia, prostate cancer
Previous surgery of the prostate
Respiratory disease resulting in significantly reduced respiratory fitness
Previous surgery of the aorta and/or iliac arteries
Previous vascular incident in the central nervous system
Major spine or pelvis trauma
Any hormonal treatment
Angina induced by cardiac rehabilitation or sexual activity
Use of antidepressants
History of psychiatric treatment

the IIEF-5 questionnaire was also administered twice with a similar 6-month interval. The analysed parameter was the total score in the IIEF-5 questionnaire. We evaluated erection quality based on the initial (EQ1) and the final (EQ2) IIEF-5 questionnaire, and we also calculated the difference between EQ2 and EQ1 (ΔEQ). Reliability of IIEF-5 questionnaire data was verified by comparing total scores obtained in the initial and repeated test (performed at least 7 days apart) in 32 patients who were randomly selected for this purpose. The IIEF-5 questionnaire is shown in Table 3.

Findings of this study required the use of non-invasive evaluation tools only within a project that was approved by

bioethics committees (95/WIM/2005, KB – 433/2010). All subjects gave informed consent for their participation in the study.

Statistical analysis

Data were reported as arithmetic mean and standard deviation. Differences in mean values between the two groups were tested using the Student *t* test for independent samples. Effects of selected factors on the analysed parameters were evaluated using the Student *t* test for paired samples. The hypothesis of equal group variance in the population was evaluated using the Levene test, the result of which determined the choice of an appropriate Student *t* test. Linear associations between variables were evaluated using the Pearson correlation coefficient, and linearity of associations between the analysed variables was assessed visually using plots of regression lines. Significance of the Pearson correlation coefficients was evaluated using the Student *t* test. $P > 0.05$ was considered statistically significant.

RESULTS

The study group was characterised by significantly higher body mass index and significantly lower left and right ventricular diastolic dimension compared to the control group, although mean values in both groups were within normal limits. Characteristics of IHD patients in the study and control groups are shown in Table 1. The study and control groups did not differ in regard to mean ExT1 (7.15 ± 1.69 vs. 7.26 ± 1.89 MET, $p = \text{NS}$) and EQ1 (12.51 ± 5.98 vs. 12.26 ± 5.83 points, $p = \text{NS}$). Following the CR cycle, a significant increase in exercise to-

Table 3. International Index of Erectile Function-5 (IIEF-5) questionnaire

How do you rate your confidence that you could get and keep an erection?		Very low	Low	Moderate	High	Very high
		1	2	3	4	5
When you had erections with sexual stimulation, how often were your erections hard enough for penetration?	No sexual activity	Almost never or never	A few times (much less than half the time)	Sometimes (about half the time)	Most times (much more than half the time)	Almost always or always
	0	1	2	3	4	5
During sexual intercourse, how often were you able to maintain your erection after you had penetrated your partner?	No sexual intercourses	Almost never or never	A few times (much less than half the time)	Sometimes (about half the time)	Most times (much more than half the time)	Almost always or always
	0	1	2	3	4	5
During sexual intercourse, how difficult was it to maintain your erection to completion of intercourse?	No sexual intercourses	Extremely difficult	Very difficult	Difficult	Slightly difficult	Not difficult
	0	1	2	3	4	5
When you attempted sexual intercourse, how often was it satisfactory for you?	No sexual intercourses	Almost never or never	A few times (much less than half the time)	Sometimes (about half the time)	Most times (much more than half the time)	Almost always or always
	0	1	2	3	4	5

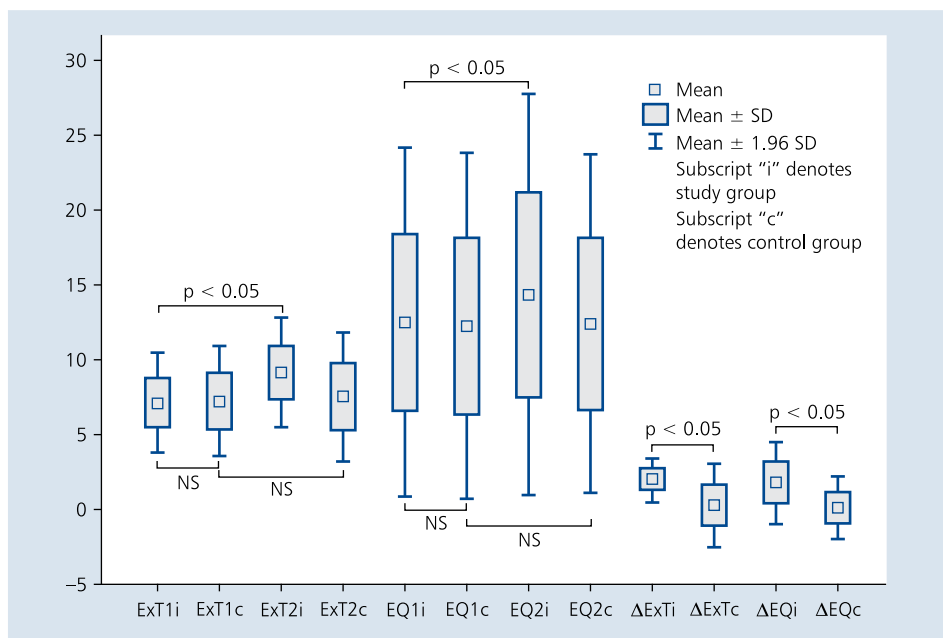


Figure 1. Initial and final values (ExT1, ExT2, Δ ExT, EQ1, EQ2, and Δ EQ) in the study and control groups and their comparisons; ExT1 — exercise tolerance during the initial exercise test; ExT2 — exercise tolerance during the final exercise test; EQ1 — initial erection quality; EQ2 — erection quality at the end of the study; Δ ExT — difference between the initial and final exercise tolerance; Δ EQ — difference between the initial and final erection quality; NS — not significant

lerance was found the study group (ExT2: 9.16 ± 1.84 MET, $p < 0.05$ vs. ExT1). In the control group, mean ExT2 was 7.57 ± 1.89 MET and it did not differ significantly from ExT1. Mean Δ ExT was 2.01 ± 0.76 MET in the study group vs. 0.31 ± 1.41 MET in the control group ($p < 0.05$). A significant increase in erection quality also was found the study group after the CR cycle (EQ2: 14.39 ± 6.82 points, $p < 0.05$ vs. EQ1). In the control group, mean EQ2 was 12.43 ± 5.75 points and it did not differ significantly from EQ1. Mean Δ EQ was 1.86 ± 1.41 points in the study group vs. 0.17 ± 1.04 in the control group ($p < 0.05$). The CR cycle was associated with a relative increase in exercise tolerance by 29.64% and in erection quality by 15.01%. These two relative increases differed significantly from each other ($p < 0.05$). Mean values of ExT1, ExT2, Δ ExT, EQ1, EQ2, and Δ EQ in the study and control groups are shown in Figure 1.

Initial exercise tolerance (ExT1) in the study group showed a significant association with age and initial erection quality (EQ1). Figure 2 shows a linear relationship between ExT1 and EQ1. Body mass index and echocardiographic parameters including left ventricular end-diastolic dimension and ejection fraction showed no significant association with ExT1. The analysed dichotomous variables (presence of hypertension, diabetes, smoking, overweight or obesity, lipid abnormalities, inappropriately low healthy physical activity, previous myocardial infarction, drug treatment with beta-blockers, renin–angiotensin–aldosterone system inhibitors, statins, and diuretics) also had no significant effect on ExT1.

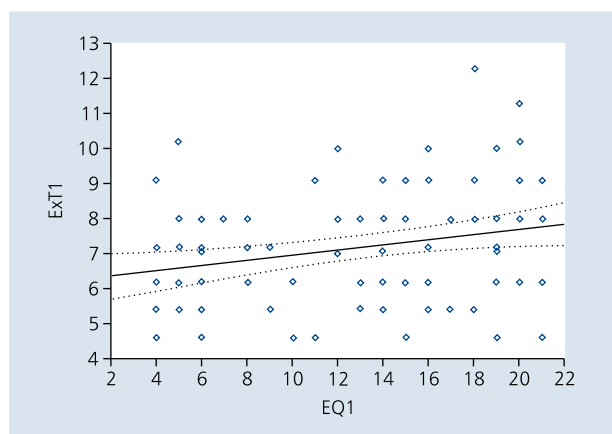


Figure 2. Relation between exercise tolerance during the initial exercise test (ExT1) and initial erection quality (EQ1) in the study group. Regression line with boundaries of the corresponding 95% confidence interval is shown. Pearson correlation coefficient $r = 0.2632$

Initial erection quality (EQ1) in the study group showed a significant association with age and initial exercise tolerance (ExT1). Of the analysed clinical variables, only the presence of hypertension and lipid abnormalities was associated with significantly lower EQ1. Δ ExT showed no significant association with any of the analysed variables, and Δ EQ was significantly associated only with age and EQ1. Δ ExT and Δ EQ were not significantly associated with each other. Sig-

Table 4. Pearson correlation coefficients for ExT1, Δ ExT, EQ1, and Δ EQ

Parameter	ExT1	Δ ExT	EQ1	Δ EQ
Age	-0.2967*	0.0342	-0.6883*	-0.4271*
ExT1		-0.0096	0.2632*	0.1186
Δ ExT			-0.0446	0.1036
EQ1				0.5608*

* $p < 0.05$; ExT1 — exercise tolerance during the initial exercise test; EQ1 — initial erection quality; Δ ExT — difference between the initial and final exercise tolerance; Δ EQ — difference between the initial and final erection quality

nificant values of the Pearson correlation coefficient for these associations are shown in Table 4. Evaluation of reliability of IIEF-5 questionnaire data showed no significant differences between scores obtained in the initial and repeated test (mean 16.53 ± 3.47 vs. 16.75 ± 3.25 , $p = \text{NS}$).

DISCUSSION

According to the National Institutes of Health Consensus Development Panel on Impotence, ED is defined as a permanent inability to achieve and/or sustain an erection sufficient for satisfactory sexual activity. Worldwide prevalence of this problem is estimated at about 150 million men, including nearly 20 million Europeans and more than 30 million American [7]. As stated by the National Institutes of Health Consensus Conference, most diseases associated with ED involve the arterial system. This is particularly true in men older than 50 years of age, in whom as much as 40% of ED cases are associated with atherosclerotic vascular disease [8]. This association between atherosclerosis and ED results from the mechanism of erection which requires input from both the autonomic nervous system and vascular endothelium. In resting conditions, the penis is kept flaccid by sympathetic activity which constricts arteries supplying blood to the two corpora cavernosa and the corpus spongiosum. Stimulation of genital mechanoreceptors or psychogenic stimulation by erotic stimuli results in inhibition of this tonic sympathetic activity and stimulation of cholinergic parasympathetic fibres. In the latter, nitric oxide acts via its second transmitter, cyclic GMP, to dilate smooth muscle of the corpora cavernosa and the arteries that supply blood to these structures. This endothelium-mediated relaxation of the corpora cavernosa with gradual increase of blood inflow to the penile tissues activates the venoocclusive mechanism which results in stiffening of the penis, allowing penetration and intercourse [9].

Our statistical analysis in the study group indicated a strong negative effect on both exercise tolerance and erection quality prior to the CR cycle. This effect of age on exercise tolerance is related to ageing and its associated physiological changes including a decrease in stroke volume and cardiac output, reduced aerobic capacity, and a reduction in mass and strength of the skeletal muscle [10]. Age-related reduction in erection quality is likely related to accumulation of risk factors

and their long-term adverse effect on vessels responsible for erection. This association was observed by Blanc et al. [11] in a population of 352 men aged 25–82 undergoing rehabilitation, and by Feldman et al. [12] in a group of 1290 healthy men aged 40–70 years who participated in the Massachusetts Male Aging Study (MMAS). In addition to age, also hypertension and lipid abnormalities, both established risk factors for ED [1], had a negative effect on erection quality in our study group.

In the study group, better erection quality was significantly associated with higher exercise tolerance. The specific nature of sexual activity combines the need to maintain appropriate exercise tolerance and good erection quality. Higher exercise tolerance is associated with less intensive body response to physical activity and subsequent exhaustion. Another important factor may be higher sympathetic activity associated with lower exercise tolerance, which inhibits erection [13]. A similar association was reported by Agostini et al. [14] in a group of 180 men aged 40–75 years.

Modification of physical activity induced by CR resulted in a significant improvement of exercise tolerance in the study group. This effect has been confirmed in numerous controlled randomised studies in large patient population that showed significant improvement of exercise tolerance in patients subjected to training compared to those who did not engage in supervised exercise [15]. Of note in the context of population ageing, these benefits were observed in all patients subjected to training regardless of their age at the time of physical activity modification [16].

In addition to this expected improvement in exercise tolerance, the CR cycle also resulted in a significant improvement of erection quality in the study group. An association between physical activity and severity of ED was seen in multiple studies in different populations. Selwin et al. [17] analysed data from the National Health and Nutrition Examination Survey (NHANES) and found a significant independent association between ED and lack of physical activity in a group of 2126 men. Interesting findings regarding the effect of physical activity modification on ED were reported by Derby et al. [2] who surveyed 593 men at two occasions. This study confirmed the importance of physical activity as a factor protecting from ED, with risk reduction

observed even when modification of physical activity took place only in middle-aged subjects.

In our study group, larger improvement of erection quality was associated with less severe ED at baseline, and with younger age of subjects undergoing CR. This is consistent with the results reported by Ruzi c et al. [18] who found that the efficacy of CR in patients after myocardial infarction was related to age and seen only in the youngest subjects aged 30–39 years.

Improvement in exercised tolerance and erection quality was not seen in the control subjects who did not participate in any CR, although patients in this group received clear instructions regarding the recommended dose and intensity of healthy physical activity.

Our analysis of the effects of CR indicates that the observed improvement in exercise tolerance was larger than the effect on erection quality. Significantly larger improvement in exercise tolerance induced by physical training is mediated by multiple adaptive mechanisms, including noncardiovascular effects that are less prone to permanent damage compared to the mechanisms underlying reduced erection quality [5, 19, 20]. We also did not find any significant relation between the observed improvements in exercise tolerance and erection quality in response to CR. This may be related to the methodology used to evaluate improvement in the latter, as the first 4 questions of the IIEF-5 questionnaire are strictly related to erection quality, and the level of exercise tolerance likely affects only the answer to the 5th question of the IIEF-5 questionnaire regarding general satisfaction from sexual activity.

In summary, ED is a major problem in a large proportion of patients with CVD who may seek help of a cardiologist also in regard to this issue. In the light of increasing prevalence of both conditions, findings of the present study suggest that standard CR should be considered an important treatment modality used in addition to conventional drug therapy.

CONCLUSIONS

1. In subjects with IHD and ED, erection quality is significantly correlated with exercise tolerance.
2. Exercise training had a positive effect on both exercise tolerance and erection quality but the size of these two effects was different and they ran independently of each other.

Conflict of interest: none declared

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Analiza związku między tolerancją wysiłku i jakością erekcji u poddanych treningowi mężczyzn z chorobą niedokrwienną serca i zaburzeniami erekcji

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Streszczenie

Wstęp: Modyfikacja aktywności ruchowej, poza korzystnym wpływem na tolerancję wysiłku i związaną z tym redukcją globalnego ryzyka sercowo-naczyniowego, korzystnie wpływa na jakość życia, zmniejszając m.in. natężenie zaburzeń erekcji prącia (ED). Specyfika aktywności seksualnej, która łączy w sobie konieczność zachowania odpowiedniej tolerancji wysiłku i dobrej jakości erekcji prącia oraz obecność wspólnego dla tych dwóch elementów czynnika stymulującego zmianę ich natężenia, jakim jest prozdrowotna aktywność ruchowa, zainspirowała do przeprowadzenia analizy związku między tolerancją wysiłku i natężeniem ED w rehabilitowanej grupie pacjentów z chorobą niedokrwienną serca (IHD) oraz ED.

Cel: Celem pracy była ocena wpływu tolerancji wysiłku na jakość erekcji u chorych z IHD i ED oraz ocena modyfikacji obu tych procesów wywołana przez cykl treningów kardiologicznych.

Metody: Analizie poddano 138 mężczyzn leczonych inwazyjnie z powodu IHD (99 — przeszłorna interwencja wieńcowa, 39 — postawienie tętnic wieńcowych), którzy we wstępnym teście IIEF-5 uzyskali 21 i mniej punktów. Chorych losowo włączono do dwóch grup. W skład grupy badanej wchodziło 103 chorych (średni wiek 62,07 ± 8,59 roku), którzy zostali poddani cyklowi rehabilitacji kardiologicznej (CR). Grupę kontrolną stanowiło 35 chorych (średni wiek 61,43 ± 8,81 roku), którzy nie zostali poddani CR. Wszyscy chorzy wypełnili początkowy i końcowy test IIEF-5 oraz 2-krotnie zostali poddani testowi wysiłkowemu na bieżni ruchomej. Cykl treningów fizycznych realizowano w okresie 6 miesięcy i obejmował on interwałowe treningi wytrzymałościowe na cykloergometrze prowadzone 3 razy w tygodniu oraz ćwiczenia ogólnousprawniające i oporowe prowadzone 2 razy w tygodniu.

Wyniki: Cykl CR w grupie badanej doprowadził do istotnej statystycznie poprawy tolerancji wysiłku (7,15 ± 1,69 vs. 9,16 ± 1,84 MET; $p < 0,05$) i poprawy jakości erekcji (12,51 ± 5,98 vs. 14,39 ± 6,82; $p < 0,05$), czego nie zaobserwowano w grupie kontrolnej. Analiza przeprowadzona w grupie badanej wskazuje na istotny wpływ wieku na postępujący spadek tolerancji wysiłku i pogarszanie się jakości erekcji, na którą negatywny wpływ wywierała także obecność u chorych nadciśnienia tętniczego i fakt palenia tytoniu. Istotna zależność między tolerancją wysiłku i jakością erekcji przed cyklem rehabilitacji wskazuje na lepszą jakość erekcji u pacjentów z lepszą tolerancją wysiłku. Przyrost tolerancji wysiłku nie wiązał się istotnie ani z początkową tolerancją wysiłku, ani z wiekiem chorych. W przeciwieństwie do tolerancji wysiłku znamiennej większa poprawa jakości erekcji miała miejsce u pacjentów młodszych i prezentujących wyjściowo najmniej natężone zaburzenia erekcji. Względny przyrost tolerancji wysiłku w grupie poddanej CR był istotnie większy od względnej poprawy jakości erekcji, przy czym obydwa procesy nie wiązały się ze sobą istotnie statystycznie.

Wnioski: 1. U pacjentów z IHD i ED jakość erekcji wiąże się istotnie statystycznie z tolerancją wysiłku. 2. Trening pozytywnie modyfikował tolerancję wysiłku i jakość erekcji, przy czym obydwa procesy były istotnie różnie natężone i przebiegały niezależnie od siebie.

Słowa kluczowe: rehabilitacja kardiologiczna, tolerancja wysiłku, zaburzenia erekcji, kwestionariusz IIEF-5

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