Published online:04/10/2015 Published print:10/2015

ORIGINAL PAPER

doi: 10.5455/medarh.2015.69.311-314
Med Arh. 2015 Oct; 69(5): 311-314
Received: August 15th 2015 | Accepted: October 02th 2015

© 2015 Abel Baltic, Rusmir Baljic, Izet Radjo, Akif Mlaco, Ifet Mahmutovic

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Health Effects of the Programmed Physical Activities on Lipid Profile in Peripheral Arterial Disease of the Lower Extremities

Abel Baltic[1], Rusmir Baljic[2], Izet Radjo[3], Akif Mlaco[1]

[1]Clinic for Vascular Diseases, Clinical Center of Sarajevo University, Sarajevo, Bosnia and Herzegovina
[2]Clinic for Infection Diseases, Clinical Center of Sarajevo University, Sarajevo, Bosnia and Herzegovina

Corresponding author: Abel Baltic, MD. Clinic for Vascular Diseases, Clinical center of Sarajevo University, Sarajevo, Bosnia and Herzegovina.

ABSTRACT

Aims: Determine health effects of programmed physical activities on blood fats in peripheral arterial disease of lower limbs or in examinees on medication therapy and examinees performing programmed physical activities along with the medication therapy. **Methods:** Overall research has been carried out at the Clinic for Vascular Disease CCUS. Before involvement into the study, examinees had to meet the inclusion criteria. Research was carried out as randomized controlled trial including 100 patients with arterial disease of lower limbs, who meet inclusion criteria: control group (CG, n=50) and test group (TG, n=50). Total level of cholesterol was used for effects assessment of 28 weeks of applied programmed activity in patients. **Results:** Values of total cholesterol (tCh) and triglycerides before and after treatment in patients of CG and TG showed statistically significant change of its mean values. Significant decrease were marked in tCh and triglycerides levels in TG compared to CG. **Conclusion:** Adequate programmed physical activities in patients with peripheral vascular disease appeared as very successful in treated patients. Results indicate statistically significant decrease of the cholesterol and triglycerides after the treatment. Physical activity used in the treatment made partial regression of arterial diseases and saved patients for undergoing to surgery. Lower level of total cholesterol represents a ten year period prevention of initial stage in progress of arterial diseases.

Key words: peripheral arterial disease, physical activity, cholesterol, triglycerides.

1. INTRODUCTION

Development of atherosclerosis and at the same time the peripheral arterial disease of lower limbs is multi gradual process resulting as a response on various forms of damages of endothelium (1). Persons with peripheral arterial disease (PAD) are at increased risk for all-cause mortality, cardiovascular mortality, and mortality from coronary artery disease (2). High level of the total cholesterol can increase further development of arteriosclerosis (3). The most of epidemiological studies discovered that increased overall cholesterol and low HDL cholesterol independently, are associated with increased risk of arterial disease of lower limbs (4). Overall research was carried out at the Clinic for Vascular Diseases CCUS. Research was conducted between two parallel groups-Test group and Control group. Aim of the research was to determine health effects of programmed physical activities on blood fats in peripheral arterial disease of lower limbs or in examinees on medication therapy and examinees who simultaneously with medication therapy performed physical activities. Primary aim was to improve quality of life in patients with peripheral arteriosclerosis, and to compare the change in total amount of blood lipids before and after the conducted program. We hypnotized that physical activity can

reduce total cholesterol and triglycerides level in patients with peripheral arteriosclerosis. Intervention has clinical application character. In patients with peripheral arterial disease the programmed physical activity is efficient in improvement of symptoms and increase in exercise capacity (5-8).

2. MATERIAL AND METHOD

Research was randomized controlled trial – parallel groups. Optimal sample size was determined using G power software. To obtain 80% power at $P < 0.05$ minimal predicted number of patients was 52 in calculated. Overall research was carried out at the Clinical for Vascular Diseases CCUS. Patients had to meet inclusion criteria. For CG – age between 40 and 55; Hospitalization due to other disease; Complications of existing disease; Self initiative interruption of therapy. TG – age range 40-55 years; Hospitalization due to other disease; Complications of existing disease; Self-initiative interruption of the therapy; noncompliance with activities of the programmed physical activities. Inclusion criteria meet 100 examinees randomly divided into two equal groups: control (n=50) (mean ± SD: age 48.6 ± 3.82) and test (n=50) (mean ± SD: 47.56 ± 3.62). All patients had prescribed or prolonged medication therapy(9). The examinees of TG were given a detailed instruction for daily program of physical activities. By analyzing the gender structure of examinees it has been established that the majority of examinees in both groups were males, 66% in control and 62% in test group, while 34% examinees in the control group and 38% examinees in the test group were females (Table 1).

		Male	Female	Test
Gender	TG	31 (62%)	19 (38%)	
	CG	33 (66%)	17 (43%)	(χ2=0.172; p=0.418)
	Total	64 (64%)	36 (36%)	
Age	TG	47.64 ± 3.74	47.76 ± 3.40	
	95% CI	(45.19 - 47.65)	(46.42 - 49.37)	
	CG	49.01 ± 4.01	49.72 ± 3.51	(F=0.445; p=0.506)
	95% CI	(47.38 - 50.95)	(47.14 - 50.44)	
		(F=0.044, p=0.835)	(F=1.232, p=0.272)	
		TG	CG	
BMI	Initial	28.54 ± 2.19	29.00 ± 2.13	(F=1.126, p=0.291)
	95% CI	(28.39 - 29.61)	(27.92 - 29.16)	
	Final	27.14 ± 2.08	28.86 ± 1.77	(F=19.694, p=0.000)
	95% CI	(28.36 - 29.63)	(26.55 - 27.73)	

Table 1. Patients characteristics in our invsetigation

Doppler sonography of pedal arteries was used for diagnostic procedure and depending from results examinees were included or excluded into the research and were classified in one of two comparative groups. Except ultrasound findings, patients gave detailed history of previous diseases, if any. Lipid panel was made for each patient (cholesterol and triglycerides). Instruments used in the research were:

Color Doppler sonography of arteriae tibialis posterior (ATP) – performed on ultrasound device Vivid 5m high-frequency probe of 12 MHz, linear 4cm. PSV (peak systolic velocity) is measured on ATP. Physiological values are calculated when PSV is determined as 30-50 cm/s. As a pathological flow we were taking values lower of higher than reference values.

Anamnesis data: smoking status, data on pre-existing diseases.

Clinical data: Laboratory data

Lipid status was determined by enzymatic photometric method on biochemical analyzer Hitachi 912, and interpreted as increased or decreased – out of reference value limits (total cholesterol: 3.5-6.5 mmol/l, triglycerides: 0.5-2.1 mm/l) – reference values of the Clinical Center laboratory, Sarajevo University

Programmed Activity Intervention

Programmed activity for TG was consisted of: warm up from 5 to 10 minutes followed by walking on treadmill or fitness, aerobic with resistance. Intensity adjustment of the loading level was in order to cause the claudication symptoms in period of 3 to 5 minutes. Exercise intensity adjustment was increased until the appearance of illness claudicating, followed by rest period in standing or sitting position until recovery. Duration of exercises: initial training lasted approximately 35 minutes and each next session approximately 5 minutes longer until maximum of 50 minutes were reached. Training frequency: 3 sessions per weeks. CG maintained their usual lifestyle. Ethical Committee publicly approved research according to procedure of the Clinical Center of the Sarajevo University and under principles proscribed by Declaration of Helsinki.

Statistical analysis

Data analysis was conducted using statistical software program SPSS (v22, IBM Corp.). Shapiro –Wilk's (normality of data distribution) and Leven's tests for homogeneity of variance for all data were calculated. Chi square (X^2- test) model 2x2 test was used for determining the differences between percentage structure of gender and smoking habits among and between groups. Changes in cholesterol and triglycerides were assessed over the experimental period for subjects of TG and CG using two factor (group x time) analysis of variance (ANOVA). Data are presented as mean ± SD (standard deviation). Significance level was set at $P < 0.05$.

3. RESULTS

The Shapiro – Wilk's test showed that data have normal distribution, and results of Leven's test reviled that there is no violation in homogeneity of variance level. This means that groups were well matched at study baseline. Analysis of the examinees' age within gropus in relation to the gender structure established that there is no statistically significant difference in age between male and female within TG (F=0.044, p=0.835) and CG (F=1.232, p=0.272). Differences in age between males and females of TG compared to CG were insignificant as well (F=0.445; p=0.506). Hi square test determined that there is no statistically significant difference in gender structure of examinees between TG and CG with male examinees prevail, (χ^2=0.172; p=0.418). At baseline patients between groups were similar in BMI value (F=1.126, p=0.291). After treatment of physical activity BMI in TG decreased significantly (F=19.694, p=0.000) compared to CG.

At baseline, anamnestic data reviled that 56% of examinees in CG and 54% of examinees in TG consumed cigarettes which was insignificant difference (χ^2=0,040; p=0,500) (Table 2). At the end point of study, all examinees have quit smoking.

			CG	TG	Total
Smoking	No	Number	22	23	45
		%	44.0%	46.0%	45.0%
	Yes	Number	28	27	55
		%	56.0%	54.0%	55.0%
Total		Number	50	50	100
		%	100.0%	100.0%	100.0%
χ^2=0,040; p=0,500					

Table 2. Percentage share of smokers in TG and CG

Findings for blood cholesterol and triglycerides were obtained at the beginning of research for each examinee (Table 3). There was no statistically significant difference in the values of cholesterol and triglycerides between TG and CG at the beginning of research (F=0.459; p=0.500) of cholesterol and triglycerides was within reference values. After intervention average value of cholesterol in examinees of the CG was 4.67±0.56 mmol/L, and in examinees of TG 4.18±0.49 mmol/L that was statistically significant difference between CG and TG (F=21.614; p=0.000). Analysis of mean values of triglycerides at the end of research did not determined statistically significant difference between CG and TG (F=2.91, p = 0.104). Mean value of triglycerides in examinees of the CG was 1.31±0.31 mmol/L, and in examinees of TG 1.21±0.25 mmol/L.

		Initial	Final
Cholesterol (mmol/L)	CG	4.68 ± 0.60	4.67 ± 0.56
	95% CI	(4.57 – 4.91)	(4.61 – 4.93)
	TG	4.61 ± 0.57	4.18 ± 0.49
	95% CI	(4.51 – 4.83)	(4.04 – 4.32)
		F=0.459; p=0.500	F=21.614; p=0.000
Triglycerides (mmol/L)	CG	1.48 ± 0.35	1.31 ± 0.31
	95% CI	(1.38 – 1.58)	(1.22 – 1.4)
	TG	1.43 ± 0.33	1.21 ± 0.25
	95% CI	(1.34 – 1.53)	(1.15 – 1.29)
		F=0.510; p=0.477	F=2.91; p=0.104

Table 3. Average values of cholesterol and triglycerides in relation to TG at the beginning and at the end of research

4. DISCUSSION

Planned physical activities as measures rehabilitation medicine are used in treatment of affected with peripheral arterial disease of a lower limbs due to its affects to: metabolism of cholesterol and triglycerides, inflammatory changes and edema, blood flow through the muscle, development of collaterals, muscle pump and causes which disturb its work, drainage of lymph liquid. In this way they contribute to stabilization, change or elimination of functional deficit caused by arteriosclerotic disease, so they present an aspect of functional treatment of the disease (10, 11). When patient achieve a possibility of quality walk the intensity of exercise should be intensified by increased walking speed in order to provide permanent stimulus to retain claudication of pain during the exercise (training is satisfactory only when symptoms appear (12). At the beginning of the study, values of cholesterol and triglycerides were within the limits of referenced values. Statistically significant difference were established at the end of study by analyzing mean values of cholesterol in both CG and TG. Statistically significant change of the mean value of the cholesterol was established by analyzing cholesterol and triglycerides values before and after the treatment in examinees of the CG and TG. Average value of the cholesterol has decreased significantly in both tested groups. This result could be due to fact that all patients quit smoking. It is common known fact that lowering smoking habit or stop consuming cigarettes can decrease total cholesterol and triglycerides levels. Claudication symptoms appear early among smokers and after quit smoking become equal like in non-smokers (13, 14) . Smoking of cigarettes depending from dosage level represent greater risk factor for peripheral arterial disease then for coroner disease. By increasing of the level and intensity of physical exercise the appearance of cardiac symptoms as well as stenocardia, arrhythmia, heavy breathing can appear (15, 16) . After completed program of intensified training any type of regular exercising should be continued. Great number of patients with symptomatic peripheral arterial disease present atypical symptoms (17). Functional diseases of peripheral arteries are conditions where the peripheral arterial circulation is disturbed and not caused by primary pathological-anatomical changes of the arterial wall but by disturbances of vascular tonus and flow in a vasospasm. This group includes Raynaud's phenomenon, acrocianosis and livedo reticularis. Atherosclerosis is focally manifested as spatially the same in the time. Typically, atherosclerosis in people is being developed during the period of several years, usually in several decades. Enlarging of atherosclerotic plaques is probably not going on by linear progression but discontinuously, with period of relative stagnancy interrupted by period of quick evolution. After usually prolonged "quite" period, arteriosclerosis may become clinically manifested (18). Even within the given vascular bed the atherosclerosis shows tendency of focal localization, typically in predisposed regions. These are mostly position of arterial bifurcation, regions of disturbed blood flow. Mechanisms which condition the interruption of continuity in anatomic distribution of atherosclerosis remain unexplained so far. (19,20). Risk factors of peripheral arterial disease are similar to those important in etiology of coronary arterial disease: smoking, dyslipidemia, diabetes mellitus and hypertension. However, for certain peripheral arterial positions the proofs connecting these factors with development of disease are limited. In addition, specific risk factors may be more significant for development of disease on certain areas (21,22) . The most of epidemiological studies have discovered that increased overall cholesterol and low HDL cholester-

ol independently are connected with increased risk for arterial disease of lower extremities. Improvements in claudication following exercise rehabilitation in patients are dependent on improvements in peripheral circulation and walking economy (23). Improving exercise tolerance through supervised exercise training is an important part of the medical treatment of peripheral arterial disease and intermittent claudication (23).

5. CONCLUSION

At the beginning of research the values of cholesterol and triglycerides are within reference values. Statistically significant difference between the control and test group was established by analyzing of average values of cholesterol at the end of research. Statistically significant change of the average value of the cholesterol was established by analyzing of the cholesterol and triglycerides values before and after the treatment in examinees of the control and test group. Average value of the cholesterol has decreased significantly in both tested groups. Adequate physical treatment of patients with peripheral vascular disease in our patient proved as very successful. Results indicate statistically significant changes of average values of cholesterol and triglycerides after the treatment of patients. There are obvious limitations of physical therapy such as diseases of muscle and joints, neurological diseases. Cardiac and/or pulmonary diseases may present limitation and decrease the capacity in achievement of adequate level of training required for maintenance of positive results. Concerning the practical aspects, such as difficulties in attendance in the session or negligence of continuous training, the actual results in clinical practice often are not so good as in those in studies. Individuals with peripheral arterial disease should accept exercising as a way of treatment.

CONFLICT OF INTEREST: NONE DECLARED.

REFERENCES

1. Hoefer IE, den Adel B, Daemen MJ. Biomechanical factors as triggers of vascular growth. Cardiovascular research. 2013; 99(2): 276-283.
2. Aronow WS. State of the art paper Peripheral arterial disease of the lower extremities. 2012.
3. Weibel GL, Drazul-Schrader D, Shivers DK, Wade AN, Rothblat GH, Reilly MP, et al. Importance of evaluating cell cholesterol influx with efflux in determining the impact of human serum on cholesterol metabolism and atherosclerosis. Arteriosclerosis, thrombosis, and vascular biology. 2014; 34(1): 17-25.
4. Jacomella V, Gerber PA, Mosimann K, Husmann M, Thalhammer C, Wilkinson I, et al. Small Dense Low Density Lipoprotein Particles Are Associated with Poor Outcome after Angioplasty in Peripheral Artery Disease. PloS one. 2014; 9(9): e108813.
5. Fokkenrood HJ, Bendermacher BL, Lauret GJ, Willigendael EM, Prins MH, Teijink JA. Supervised exercise therapy versus non supervised exercise therapy for intermittent claudication. The Cochrane Library. 2013.
6. Lane R, Ellis B, Watson L, Leng GC. Exercise for intermittent claudication. The Cochrane Library. 2014.
7. McDermott MM, Guralnik JM, Criqui MH, Liu K, Kibbe MR, Ferrucci L. Six-minute walk is a better outcome measure than treadmill walking tests in therapeutic trials of patients with peripheral artery disease. Circulation. 2014; 130(1): 61-68.
8. Popplewell M, Bradbury A. Why do health systems not fund supervised exercise programmes for intermittent claudication? European Journal of Vascular and Endovascular Surgery. 2014; 48(6): 608-610.
9. Tendera M, Aboyans V, Bartelink M-L, Baumgartner I, Clément D, Collet J-P, et al. ESC Guidelines on the diagnosis and treatment of peripheral artery diseases Document covering atherosclerotic disease of extracranial carotid and vertebral, mesenteric, renal, upper and lower extremity arteriesThe Task Force on the Diagnosis and Treatment of Peripheral Artery Diseases of the European Society of Cardiology (ESC). European heart journal. 2011; 32(22): 2851-2906.
10. Murphy TP, Cutlip DE, Regensteiner JG, Mohler ER, Cohen DJ, Reynolds MR, et al. Supervised Exercise Versus Primary Stenting for Claudication Resulting From Aortoiliac Peripheral Artery Disease Six-Month Outcomes From the Claudication: Exercise Versus Endoluminal Revascularization (CLEVER) Study. Circulation. 2012; 125(1): 130-139.
11. Schlager O, Giurgea A, Schuhfried O, Seidinger D, Hammer A, Gröger M, et al. Exercise training increases endothelial progenitor cells and decreases asymmetric dimethylarginine in peripheral arterial disease: a randomized controlled trial. Atherosclerosis. 2011;217(1): 240-248.
12. Medicine ACoS. ACSM's guidelines for exercise testing and prescription: Lippincott Williams & Wilkins; 2013.
13. Fritschi C, Collins EG, O'Connell S, McBurney C, Butler J, Edwards L. The Effects of Smoking Status on Walking Ability and Health-related Quality-of-Life in Patients with Peripheral Arterial Disease. The Journal of cardiovascular nursing. 2013; 28(4): 380.
14. Ratchford EV, Black III JH. Approach to smoking cessation in the patient with vascular disease. Current treatment options in cardiovascular medicine. 2011;13(2): 91-102.
15. Fletcher GF, Ades PA, Kligfield P, Arena R, Balady GJ, Bittner VA, et al. Exercise Standards for Testing and Training A Scientific Statement From the American Heart Association. Circulation. 2013; 128(8): 873-934.
16. Mezzani A, Hamm LF, Jones AM, McBride PE, Moholdt T, Stone JA, et al. Aerobic exercise intensity assessment and prescription in cardiac rehabilitation: a joint position statement of the European Association for Cardiovascular Prevention and Rehabilitation, the American Association of Cardiovascular and Pulmonary Rehabilitation and the Canadian Association of Cardiac Rehabilitation. European journal of preventive cardiology. 2013; 20(3): 442-467.
17. van Zitteren M, Vriens PW, Heyligers JM, Burger DH, Nooren MJ, de Fijter WM, et al. Self-reported symptoms on questionnaires and anatomic lesions on duplex ultrasound examinations in patients with peripheral arterial disease. Journal of vascular surgery. 2012; 55(4): 1025-134.
18. Freitas WM, Carvalho LSF, Moura FA, Sposito AC. Atherosclerotic disease in octogenarians: a challenge for science and clinical practice. Atherosclerosis. 2012; 225(2): 281-289.
19. Hirsch AT, Duval S. The global pandemic of peripheral artery disease. The Lancet. 2013; 382(9901): 1312-1314.
20. Libby P, Lichtman AH, Hansson GK. Immune effector mechanisms implicated in atherosclerosis: from mice to humans. Immunity. 2013; 38(6): 1092-1104.
21. Association AP. Diagnostic and statistical manual of mental disorders, (DSM-5®): American Psychiatric Pub; 2013.
22. Fletcher RH, Fletcher SW, Fletcher GS. Clinical epidemiology: the essentials: Lippincott Williams & Wilkins; 2012.
23. Gardner AW, Parker DE, Montgomery PS, Scott KJ, Blevins SM. Efficacy of quantified home-based exercise and supervised exercise in patients with intermittent claudication a randomized controlled trial. Circulation. 2011; 123(5): 491-498.