



Artery Research

ISSN (Online): 1876-4401

ISSN (Print): 1872-9312

Journal Home Page: <https://www.atlantis-press.com/journals/artres>

P.092: EXERCISE IS A PROTECTIVE FACTOR AGAINST ARTERIAL STIFFNESS RESULTS FROM THE MONICA/KORA AUGSBURG STUDY

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To cite this article: M.R.P. Markus, J. Stritzke, W. Lieb, B. Mayer, A. Luchner, A. Döring, U. Keil, H.W. Hense, H. Schunkert (2007) P.092: EXERCISE IS A PROTECTIVE FACTOR AGAINST ARTERIAL STIFFNESS RESULTS FROM THE MONICA/KORA AUGSBURG STUDY, Artery Research 1:2, 73–74, DOI: <https://doi.org/10.1016/j.artres.2007.07.026>

To link to this article: <https://doi.org/10.1016/j.artres.2007.07.026>

Published online: 21 December 2019

consisted of 19 healthy volunteers (16 women and 3 men) matched in age (the age of 21–62 years) and body mass index (BMI). Assessment of endothelial function was performed in the brachial artery using high-resolution vascular ultrasonography by standard method for the assessment of endothelium-dependent vasodilatation (EDV) Also level of von Willebrand factor (VWF) has been studied. Studies were performed before and after treatment of β -blockers during 3 weeks. After the first examination, patients were randomised in to 2 groups. 1st group was treated by nebulivol (2,5 mg/day), 2nd group was treated by metoprolol (25 mg/day). Before treatment level of VWF has been increase ($97,7 \pm 8,7\%$) in comparison with control group ($46,8 \pm 7,3\%$, $p < 0,01$) and EDV has been decreased at 50% of patients. After treatment FW has not varied in group 1 ($98,6 \pm 6,9\%$) compared in control, but has increased in group 2 ($119,8 \pm 8,8\%$). EDV was normalized at 60% of patients in group 1, but has not varied in group 2. These results demonstrated, first, that the endothelial dysfunction developed at ST, in the second, that these changes can be removed by therapy of nebulivol.

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INFLUENCE OF A SUBCLINICAL THYROTOXICOSIS ON HEART IN VARIOUS AGE-GRADES

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Subclinical thyrotoxicosis (ST) characterized by low serum TSH and normal FT₄ and FT₃ concentrations. ST may cause changes of geometry of heart and developments of diastolic dysfunction. Influence of ST on this evolutions depending on age of patients, duration of ST, effect of TSH level is not clear. In present research the effects of ST on changes of EchoCG at a different age were studied. The present study includes 102 normotensive patients with ST without any CVD (the age of 20-60 years, 10 men and 92 women) The patients were examined echocardiography by standard method. The patients were distributed on 3 age-grades: 1st group (gr1) (n=22) – 20-35 years; 2-nd group (gr2) (n=32) - 35-45 years and 3-rd group (gr3) (n=48) - 45-60 years. The parameters EchoCG were normal in patients of gr1 and gr2: relative wall thickness (RWT) ($0,34 \pm 0,009$ and $0,35 \pm 0,01$ cm), left atrial diameter (LAD) ($3,8 \pm 0,09$ and $3,8 \pm 0,07$ cm), isovolumic relaxation time (IVRT) ($93,8 \pm 1,93$ and $92,7 \pm 3,1$ msec) left ventricular mass index (LVMI) ($83,6 \pm 3,24$ and $90,5 \pm 5,1$ g/m²). However, the mean RWT ($0,41 \pm 0,01$ cm, $p < 0,05$), LAD ($4,1 \pm 0,18$ cm, $p < 0,05$), IVRT ($100,6 \pm 4,1$ msec, $p < 0,05$) and LVMI ($103,2 \pm 7,3$ g/m² $p < 0,05$) in patients gr3 was higher than that in gr1 and gr2. The frequency of left ventricular hypertrophy (LVH) was in gr1 – 10%, in gr2 – 8,3%, in gr3 – 36,4%, left atrial enlargement (LAE) was in gr1 – 25%, in gr2 – 20,8%, in gr3 – 35,5%, diastolic dysfunction (DD) was in gr1 – 30%, in gr2 – 31,8%, in gr3 – 47,4%, increase pulmonary pressure >30 (IPP) was in gr1 – 19%, in gr2 – 59%, in gr3 – 19%. The level T3, T4 was highly positive correlated with LAD ($r=0,32$, $p < 0,05$) and pLA ($r=0,55$, $p < 0,01$) and level TSH was highly negative correlated with pLA ($r=-0,31$, $p < 0,05$). The LVMI and IVRT were positive correlated both with age ($r=0,49$, $p < 0,01$ and $r=0,34$, $p < 0,05$) and level T3 ($r=0,32$, $p < 0,05$ and $r=0,25$, $p < 0,1$). Specific attributes of influence of ST on a heart were appearance of IPP, LAE and DD, which were meet at any age with high often. The LVH was less characterised at ST and frequency of its development at young age is similar as in a comparable population on age. Frequency of LVH was significantly higher in patients >45 years old.

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BASELINE PULSE WAVE VELOCITY IS AN INDEPENDENT PREDICTOR OF THE BLOOD PRESSURE REDUCTION AND EFFECTIVE BLOOD PRESSURE CONTROL: THE REASON STUDY

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Background-Aim: The degree of blood pressure reduction remains the corner stone of a successful treatment in hypertension. Various parameters have been evaluated in order to predict the response to drug treatment, but no single marker has been found to predict the response to blood treatment. Arterial stiffening is a dominant trait of aging and is further accelerated by numerous cardiovascular risk factors which have been evaluated as predictors of the response to antihypertensive drug treatment. We sought to investigate whether baseline arterial stiffness is a predictor of the response to drug treatment.

Methods: 375 subjects were investigate in an intention to treat prospective study and were randomly allocated to receive atenolol 50 mg or perindopril 4 mg/indapamide 2.5 mg, for 12 months. Carotid-femoral pulse wave velocity (PWV) and classical cardiovascular risk factors were assessed at baseline.

Results: PWV was a predictor of systolic and diastolic blood pressure change after 12 months, independently from age, gender, medication, cardiovascular risk factors and baseline blood pressure. Similarly, PWV was also an independent predictor of the presence of effective blood pressure control after 12 months of treatment. Finally, those subjects within the highest tertile of baseline PWV, demonstrated the lowest blood pressure reduction after 12 months, even after adjustment for age, gender, medication and baseline blood pressure.

Conclusion: Increased large artery stiffness is associated and predicts reduced response to antihypertensive drugs; future investigations are needed to show whether it could be a useful tool in clinical use.

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A PATIENT SPECIFIC WAVE PROPAGATION MODEL OF THE UPPER LIMB

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In this study, a patient specific lumped parameter model is used to investigate pressure wave propagation phenomena and estimate mechanical properties of large arteries of the upper limb.

A set of local ultrasound measurements was obtained from a group of 7 healthy volunteers to provide vessel wall distension (WD) and blood velocity at several positions. Blood volume flow (BVF) is estimated from the centerline velocity using the Womersley profile method. The lumped parameters R, L, C along the arm are computed with a linear interpolation method from local blood pressure (BP) and WD. Thus, an entire arterial tree model, from the arm pit to the wrist, modeling the brachial, radial and ulnar arteries, is built. Time average BVF and BP values are used to determine the end impedance of the extremities. The BVF at the more proximal site is used as input for the simulations.

Simulated BVF and BP curves are compared with the in-vivo results. A reverse method adapts the model parameters resulting in values reflecting physiological results.

The results show that the shape of the simulated BVF along the arm is comparable with the in-vivo estimations. However, large differences are observed between simulated BP and in-vivo assessed WD curves. We hypothesize that those differences are due to the non-linear and visco-elastic properties of the arterial wall. Therefore, a continuous wave propagation model which takes those properties into account should be implemented. The experimental simulations provide and suggest improved physiological modeling of the pressure/flow relationships.

P.092

EXERCISE IS A PROTECTIVE FACTOR AGAINST ARTERIAL STIFFNESS RESULTS FROM THE MONICA/KORA AUGSBURG STUDY

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Background: Evolving evidence suggests that exercise could attenuate or even revert the continuous increase of arterial stiffness mediated by aging or risk factors like high blood pressure. We aimed to study whether exercise has protective effects on arterial stiffness.

Methods: Subjects (n=882, aged 35 to 84 years), who originated from a gender and age stratified random sample of German residents of the Augsburg area, were examined by standardized applanation tonometry. We defined two groups of individuals, one who practiced sports at least 1 hour per week (exercise group; n = 468) and one who practiced no sports or did at an irregular way (sedentary group; n = 414). We evaluated cross sectionally the adjusted mean values of the augmentation index at heart rate of 75 (AI), the subendocardial viability index (SVI) and the aorta pulse pressure (APP) using linear regression models adjusting for age, sex, fat-free mass, body fat and systolic and diastolic blood pressure.

Results: Individuals who practiced sports, as compared to sedentary individuals, showed smaller augmentation index at heart rate of 75 (AI, 21.7

[95% CI: 20.9 to 22.5] versus 23.4 [22.6 to 24.2]; $p=0.004$), larger subendocardial viability index (SVI, 173.8 [171.2 to 176.5] versus 169.6 [166.8 to 172.4]; $p=0.033$) and no significant difference in aorta pulse pressure (APP). **Conclusions:** Regular aerobic-endurance exercise attenuates age-related reductions in central arterial compliance and increases the subendocardial blood flow. This may be two mechanisms by which habitual exercise could lower the risk of cardiovascular disease in this population.

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ROLE OF HEART FAILURE ETIOLOGY ON ARTERIAL WAVE REFLECTION IN HEART TRANSPLANT RECIPIENTS: RELATION WITH CIRCULATING C-REACTIVE PROTEIN

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Background: Aortic augmentation index (AI_a), a measure of arterial pressure wave reflection related to central and/or peripheral arterial stiffness, is elevated in many heart transplant recipients (HTRs). C-reactive protein (CRP), a marker of systemic inflammation associated with ischemic heart disease, is an independent predictor of cardiac allograft vasculopathy and death in HTRs. We hypothesized that arterial wave reflection would be higher in HTRs with ischemic compared with non-ischemic heart failure etiology and this would be associated with circulating CRP early after transplantation.

Methods: Two months after heart transplantation, 20 HTRs underwent non-invasive measurement of aortic pressure and wave reflection properties adjusted for heart rate (Sphygmocor, AtCor Medical) and plasma metabolic and inflammatory markers.

Results: Aortic AI_a was higher in HTRs with ischemic ($n=12$) compared with non-ischemic ($n=8$) heart failure (mean±SD; 22.5 ± 11.0 vs. $11.6 \pm 10.5\%$, $p<0.01$). Similarly, circulating CRP was higher in HTRs with ischemic compared with non-ischemic heart failure (5.4 ± 4.5 vs. 1.4 ± 1.1 mg/L, log transformed $p<0.05$). Moreover, there was a significant relation between logCRP and AI_a ($r=0.68$, $p<0.05$), roundtrip time of the reflected wave to the peripheral reflecting sites and back ($r=-0.62$, $p<0.01$), and left ventricular wasted energy ($r=0.55$, $p<0.01$). When adjusted for CRP, the difference in AI_a between groups was abolished suggesting that circulating CRP contributed in part to the group differences in wave reflection.

Conclusions: HTRs with ischemic heart failure etiology demonstrated increased arterial wave reflection compared with HTRs with non-ischemic heart failure early after transplantation and this was associated with higher circulating CRP.

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CAROTID ATHEROSCLEROSIS ASSOCIATED TO METABOLIC SYNDROME AND ISCHEMIC HEART DISEASE IN HYPERTENSIVE PATIENTS WITH LEFT VENTRICULAR HYPERTROPHY

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Metabolic syndrome (MS) is one of the numerous risk factors for some patients with cardiovascular diseases. Aims: 1. to prove the presence of MS at patients with hypertension and left ventricular hypertrophy (LVH) analyzing clinical parameters; 2. to estimate the impact of MS on patient prognosis.

Method: There have been analyzed 73 hypertensive patients (43 male), average age 56.3 ± 8.5 with echocardiographically proved LVH (average LVMI 163.5 ± 31.8 g/m²).

Results: 36 patients (55 ± 8 years) fulfilled the criterion of MS. They had significantly higher glucose level, lower HDL cholesterol, higher triglycerides and higher body mass index (29.6 ± 3.8 vs. 27.8 ± 3 , $p<0.03$). This group of patients had more frequent complex VA and significantly lower values of HRV. After nine years of observation, four patients in this group had fatal CV events (3 CVI—3 deaths, 1 sudden death), while in the second group, two patients had two sudden deaths (ns).

The purpose of this study was to investigate the subclinical carotid atherosclerosis prevalence in different groups, with and without metabolic syndrome. ColourDuplex ultrasonography of the carotid arteries was performed on Acuson Sequia C236 with high-frequency linear probe with 8 MHz. The thickness of the intima-media complex in patients with MS was 1.03 ± 0.03 vs. 0.99 ± 0.02 mm in patients without MS. Twelve patients with MS (33%) had carotid plaques, and at 43% of patients had been diagnosed

coronary disease (3 IM, 2 PTCA with inbuilt stent, ten with angina pectoris and positive exercise tests), while 20% of patients with non MS had carotid plaques ($p<0.04$), and 9% had coronary disease (3 with angina pectoris and positive exercise tests) ($p<0.002$).

Conclusions: Results of our study showed that patients with LVH and MS had significantly greater prevalence of the carotid atherosclerosis and CAD, and high correlation between carotid artery disease and presence and severity of CAD.

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THE DISPARATE EFFECTS OF MICROVASCULAR RAREFACTION AND REDUCED COMPLIANCE ON PROXIMAL HAEMODYNAMICS: INVESTIGATION WITH A MATHEMATICAL AND COMPUTATIONAL MODEL OF THE CIRCULATION

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The fundamental haemodynamic interaction between large and small vessels is important and poorly understood. We aimed to investigate the effect of microvascular rarefaction (MR) and reduced small vessel compliance (SVC) using a mathematical and computational model of the systemic arterial circulation.

Systemic arteries are treated as a bifurcating tree of compliant and tapering vessels. Large and small vessels are treated separately. MR is modelled by altering the area ratio between parent and daughter vessels at bifurcations. Reduced SVC is modelled by altering the value for Young's modulus within structured trees. Aortic flow profiles (from MRI) of 7 healthy subjects (mean age 51.6y) were used as input to the model. Runs were made at baseline (normal parameters), with modelled MR (area ratio 1.08) and reduced SVC (20% reduction). Pressure and flow waveforms were generated at ascending aorta and radial artery.

Results expressed as change from baseline values. Radial artery (i) decreased compliance - SBP[+3.3%], DBP[-2.6%], pulse pressure (PP)[+13.3%] (i) rarefaction SBP[+12.7%], DBP[+21.1%], PP[-1.4%]. Ascending aorta (i) decreased compliance SBP[+3.3%], DBP[-2.6%], PP[+18.5%] (ii) rarefaction SBP[+10%], DBP[+19.3%], PP[-13.4%].

The predominant effect of decreasing SVC was an increase in pulse pressure with a small increase in peak pressure. Increased MR lead to an increase in both systolic and diastolic pressures with reduced central pulse pressure. These results represent modelled changes in small vessel properties only, with no changes made to large artery parameters. These results suggest that such model represents a useful tool in investigating haemodynamic mechanism, with multiple potential physiological and clinical applications.

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ROLE OF ARGINASE PATHWAY IN RESPONSE TO SHEAR STRESS: NEW POTENTIAL THERAPEUTIC TARGETS FOR ATHEROSCLEROSIS?

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Introduction: Alterations of wall shear stress can predispose the endothelium to the development of atherosclerotic plaques. Ample evidence indicates that arginase expression and/or activity correlates with several risk factors for cardiovascular disease including atherosclerosis.

Methods: To evaluate the regulation of arginases by different shear stress patterns without neuroendocrine factors, we perfused carotid arterial segments to unidirectional high and low shear stress, and oscillatory shear stress. After 3 days of flow exposure, vascular function, arginase expression and localization were analyzed. We compared these well-controlled measurements to an *in vivo* model of shear stress-induced atherogenesis. In brief, the carotid artery of ApoE^{-/-} mice, fed with high cholesterol diet, was exposed to similar hemodynamic conditions by the placement of a shear stress modifier for 9 weeks.

Results: Our results showed for the first time that exposure of carotid segments to high shear stress conditions (athero-protective) significantly