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### **P.088: ENDOTHELIAL DYSFUNCTION AND ITS CORRECTION IN SUBCLINICAL THYROTOXICOSIS**

A.J. Babenko, A.V. Liscer, M.I. Cadinskaya

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the corresponding risk. Moreover, we sought to explore possible underlying mechanisms, notably inflammation, platelet activation, endothelial function and oxidative stress.

**Methods:** 18 healthy volunteers (age  $28 \pm 5$  years) watched a 30 minutes long segment of a comic film. Measurements were made before, 0, 15 and 30 minutes after the movie. Carotid-femoral pulse wave velocity (cfPWV) was measured as an index of aortic stiffness. Wave reflections were studied using arterial tonometry; augmentation index (AIx) was measured as index of wave reflections. Blood samples were drawn before and 15 minutes after the movie. P selectin levels, soluble vascular cell adhesion molecule 1 (sVCAM-1), total antioxidant status (TAS) were measured by enzyme-linked immunosorbent assay.

**Results:** Laughter induced by the comedy led to a significant decrease in cfPWV by 0.30 m/sec and AIx by 3.83% (both at 15 minutes,  $p < 0.05$ ). P selectin levels decreased by 18 ng/mL, sVCAM-1 decreased by 47.56 ng/mL, (all  $p < 0.05$ ). TAS did not change significantly,  $p = 0.47$ .

**Conclusions:** This study shows that laughter has a beneficial effect on arterial elastic properties and wave reflections. Attenuation of endothelial injury, platelet activation and inflammatory response, as indicated by decreased levels of P selectin and sVCAM-1, is a possible underlying pathway, while oxidative status is not altered.

#### P.083

##### COMPARISON OF LOCAL CAROTID AND AORTIC STIFFNESS PARAMETERS IN MILD ESSENTIAL HYPERTENSIVE PATIENTS

C. Giannarelli<sup>1</sup>, E. Bianchini<sup>2</sup>, K. Raimo<sup>1</sup>, L. Landini<sup>1</sup>, F. Fata<sup>2</sup>, V. Gemignani<sup>2</sup>, M. Demi<sup>2</sup>, L. Ghiadoni<sup>1</sup>. <sup>1</sup>*Department of Internal Medicine, University of Pisa, Pisa, Italy*, <sup>2</sup>*Institute of Clinical Physiology, National Research Council, Pisa, Pisa, Italy*

Arterial stiffness (AS) can be evaluated by local pulse pressure (PP) and arterial diameter changes. We aimed to compare local AS, by an automatic edge detection system, with pulse wave velocity (PWV), the "gold standard" for AS.

In 27 patients (males 16, age  $40 \pm 7$  years) with mild hypertension (HT) and 15 age and gender matched controls (NT), we measured carotid pulse pressure PP and central PWV by applanation tonometry (SphygmoCor®). Diameter changes were measured by a contour tracking algorithm applied to B-mode longitudinal scans of common carotid artery. The algorithm is implemented on a stand-alone video processing system which acquires and analyzes video signal showing results in real-time. Distension (D) was calculated as systolic minus diastolic diameter. Stroke change in lumen area ( $\delta A$ ) and lumen area (A) were evaluated from diameter and D values. The cross-sectional distensibility coefficient ( $DC = \delta A / (A \cdot PP)$ ) was converted (Bramwell-Hill equation) into a parameter ( $CS = (DC \cdot \rho)^{-1/2}$ ,  $\rho =$  blood density) with same measurement units of PWV.

HT showed a significantly ( $p < 0.0001$ ) higher PWV ( $8.48 \pm 1.45$  m/s) than NT ( $5.44 \pm 0.45$  m/s). PP was similar in HT ( $60 \pm 14$  mmHg) and NT ( $58 \pm 11$ ). Carotid diameter was higher in HT ( $7.67 \pm 0.67$  mm) than NT ( $6.76 \pm 0.40$  mm). Carotid stiffness was higher in HT ( $CS = 7.35 \pm 0.93$  m/s) than in NT ( $CS = 5.76 \pm 0.74$  m/s;  $p < 0.0001$ ). PWV correlated with CS ( $r = 0.66$ ;  $p < 0.0001$ ).

In conclusion, CS discriminates between HT and NT and is related with PWV. Automatic detection of carotid stiffness from ultrasound provide similar and/or complementary information to central PWV.

#### P.084

##### VISCERAL ADIPOSITY AS THE MAIN DETERMINANT OF CAROTID STIFFNESS IN A HEALTHY POPULATION WITH A WIDE BMI AND AGE RANGE: EVIDENCE FROM AN ECHO-TRACKING APPROACH

E. Guerra, E. Malshi, C. Morizzo, M. Kozakova, S. Camastra, E. Muscelli, C. Palombo, E. Ferrannini. *Department of Internal Medicine, University of Pisa, Pisa, Italy*

**Introduction:** Aging and blood pressure have been reported to be the main determinants of systemic arterial stiffening but few data exist on factors influencing local arterial stiffness.

**Aim:** Evaluation of metabolic, hemodynamic and anthropometric determinants of carotid artery stiffness.

**Materials:** 145 normotensive, non-diabetic, non-dyslipidemic subjects were studied; according to WHO criteria the population included 44 normal 30 overweight and 71 obese subjects [NL, OW, and OB (mean age  $40 \pm 11.4$ ,

$44.4 \pm 10$ , and  $39.2 \pm 12$  yrs, mean BMI  $22.6 \pm 1.9$ , BMI  $28.2 \pm 1.6$ , and  $39.5 \pm 6.2$  kg/m<sup>2</sup>, respectively)]. 106 subjects underwent oral glucose tolerance test; blood samples for glucose, insulin, c-peptide, total HDL- and LDL-cholesterol, and triglyceride levels collected. Carotid artery stiffness was evaluated by a cardiovascular ultrasound system (Aloka SSD-5500) implemented with an echo-tracking subsystem allowing real time evaluation of arterial diameter, and providing calibrated diameter-derived pressure curves. Indices of local arterial stiffness such as pressure-strain elastic modulus (EP), b stiffness index, and pulse wave velocity (PWV), and the augmentation index (AIx) were obtained. **Results:** carotid PWV correlated ( $p < 0.05$ ) directly with: age ( $r = 0.407$ ); SBP, DBP and MBP ( $r = 0.343$ ,  $0.285$  and  $0.330$ , respectively); mean carotid IMT ( $r = 0.219$ ), waist-hip ratio (WHR,  $r = 0.511$ ); AUC for C-peptide (60 subjects) ( $r = 0.359$ ), Framingham risk score ( $r = 0.319$ ) and inversely with HDL cholesterol ( $r = -0.231$ ). In stepwise regression analysis WHR remained as main independent determinant of local carotid PWV ( $r^2 = 0.396$ ,  $p < 0.001$ ). **Conclusions:** Visceral adiposity is the main determinant of arterial stiffness in a healthy population with wide BMI and age range.

#### P.085

##### METABOLIC SYNDROME AND VASCULAR ALTERATIONS IN NORMOTENSIVE PATIENTS AT RISK OF DIABETES MELLITUS

C. Giannarelli, Y. Plantinga, L. Ghiadoni, G. Penno, A. Salvetti, S. Del Prato. *University of Pisa, Pisa, Italy*

The aim of the study was to evaluate the possible early vascular abnormalities associated with the presence (MS+) or absence (MS-) of the metabolic syndrome (MS), according to ATP III criteria, in normotensive patients at risk of developing diabetes.

In 77 subjects (age: 50 years), with family history of diabetes, obesity or impaired fasting glucose and blood pressure (BP)  $< 140/90$  mmHg and 50 age-matched healthy subjects, we measured brachial artery flow-mediated dilation (FMD) and response glyceryl trinitrate (GTN). Carotid-femoral pulse wave velocity (PWV) and radial augmentation index (AI) were assessed by applanation tonometry (Sphygmocor).

FMD was similarly reduced ( $*p < 0.05$ ) in both MS+ and MS- patients. PWV was higher ( $**p < 0.01$ ) in MS+ than in MS- patients and controls. Response to GTN and radial AI were similar.

	MS+ (27)	MS- (50)	Controls (50)
FMD (%)	$6.1 \pm 3.7^*$	$5.8 \pm 2.7^*$	$6.9 \pm 2.5$
PWV (m/s)	$9.0 \pm 1.9^{**}$	$7.7 \pm 1.2$	$7.2 \pm 1.5$

PWV significantly ( $p < 0.05$ ) increased with the increased number of MS components (from 0 to more than 3). Comparing patients with BP greater (BP+,  $n = 39$ ) or lower (BP-,  $n = 39$ ) than 130/85 mmHg, PWV was ( $p < 0.05$ ) higher in BP+ patients ( $8.5 \pm 1.9$  m/s) as compared to BP- patients ( $7.8 \pm 1.9$  m/s). FMD was ( $p < 0.05$ ) lower in BP+ ( $5.2 \pm 2.6\%$ ) than in BP- patients ( $6.9 \pm 1.9\%$ ). No differences were found for AI. The other single components did not influence vascular parameters.

In conclusion in normotensive patients at risk of developing diabetes mellitus MS is associated with increased central PWV and only blood pressure values negatively influence arterial stiffness and endothelial function.

#### P.088

##### ENDOTHELIAL DYSFUNCTION AND ITS CORRECTION IN SUBCLINICAL THYROTOXICOSIS

A.J. Babenko, A.V. Liscer, M.I. Cadinskaya. *Saint-Petersburg Medical State University named after I.P. Pavlov, Saint-Petersburg, Russian Federation*

The mechanisms by which thyroid hormones affect vascular physiology are mostly unknown. Nevertheless, few data are available regarding the effects of thyroid hormones on endothelial function. Experimental and clinical results give of conflicting information, but the influence of hyperthyroidism on endothelium-dependent relaxation is connected with the change of production of Nitric Oxide. The effects of subclinical thyrotoxicosis (ST) on endothelial function and possibility its correction are unknown. ST characterized by low serum TSH and normal FT<sub>4</sub> and FT<sub>3</sub> levels. The present study includes 49 normotensive patients with ST without any CVD (the age of 20-60 years, 5 men and 44 women); mean serum TSH level  $- 0.09 \pm 0.01$  mU/l (normal range, 0.4–4.6 mU/l). The control group

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  $\beta$ -blockers during 3 weeks. After the first examination, patients were randomized 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.

#### P.089

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

E.N. Grineva, A.J. Babenko, N.V. Vahrameeva. *St.Petersburg State Medical University named after I.P.Pavlov, Saint-Petersburg, Russian Federation*

Subclinical thyrotoxicosis (ST) characterized by low serum TSH and normal  $FT_4$  and  $FT_3$  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/m<sup>2</sup>). 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/m<sup>2</sup>  $p < 0,05$ ) 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.

#### P.090

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

A.D. Protogerou<sup>1</sup>, J. Blacher<sup>2</sup>, M.E. Safar<sup>2</sup>. <sup>1</sup>*Medical School University of Athens, Athens, Greece*, <sup>2</sup>*Paris-Descartes University, Faculty of Medicine, Hôtel-Dieu Hospital, AP-HP, Paris, France*

**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 investigated 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.

#### P.091

##### A PATIENT SPECIFIC WAVE PROPAGATION MODEL OF THE UPPER LIMB

C.A.D. Leguy<sup>1</sup>, E.M.H. Bosboom<sup>1</sup>, A.P.G. Hoeks<sup>2</sup>, F.N. Van de Vosse<sup>1</sup>. <sup>1</sup>*University Hospital Maastricht, Maastricht, Netherlands*, <sup>2</sup>*Cardiovascular Research Institute Maastricht, Maastricht, Netherlands*

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

M.R.P. Markus<sup>1</sup>, J. Stritzke<sup>1</sup>, W. Lieb<sup>1</sup>, B. Mayer<sup>1</sup>, A. Luchner<sup>3</sup>, A. Döring<sup>4</sup>, U. Keil<sup>2</sup>, H.W. Hense<sup>2</sup>, H. Schunkert<sup>1</sup>. <sup>1</sup>*University of Lübeck, Lübeck, Germany*, <sup>2</sup>*University of Münster, Münster, Germany*, <sup>3</sup>*Institute for Epidemiology, Neuherberg, Germany*, <sup>4</sup>*Clinical University of Regensburg, Regensburg, Germany*

**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