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CAROTID ARTERY WAVE INTENSITY ANALYSIS IN HEALTHY HUMANS DURING EXERCISE

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Background: The study of wave reflections in the carotid artery may reveal the vasoactive response of the cerebral circulation to exercise, which is not yet fully characterised. Therefore, we aim to examine the effect of exercise on wave intensity parameters measured in the carotid artery of healthy humans, using non-invasive wave intensity analysis.

Methods: Ultrasound measurements of right common carotid diameter and flow velocity were obtained from 8 healthy male athletes (27 ± 4 y). Two measurements were taken at rest, followed by measurements during 5-min incremental steps of cycling at 0%, 20%, 40%, 60% and 70% of the subjects’ peak workload, then eight measurements during post-exercise recovery. Wave speed (c) and the intensity peaks and energies of Forward (FEW) were determined and compared between the three stages. The reflection index (RI) is calculated as RI = BCW/FCW.

Results: All parameters increased, following the increase of workload. At end of recovery, all parameters returned to rest values. During exercise, c increased by 200%. The intensity of FCW, BCW and FEW increased by 600%, 1100% and 400% during exercise; likewise the energy increased by 450%, 500% and 800%, respectively. Also, RI increased during exercise by 170%.

Conclusions: RI results indicate that cerebral resistance increases with increased workload. Also, the increase of FEW magnitude suggests that an increase in exercise workload is associated with a greater cardiac muscle speed of deceleration in late systole.

THE ROLE OF HYALURONAN IN AORTIC STIFFENING IN PATIENTS WITH RHEUMATOID ARTHRITIS

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Growing evidence shows that patients with rheumatoid arthritis (RA) have up to twice the risk of developing cardiovascular disease (CVD) compared to those without RA. Generally, these RA patients have higher levels of inflammation in their bodies, and this inflammation is thought to be the link between RA and CVD, but the mechanism is poorly understood. One possibility is through the overproduction of hyaluronan (HA) in the extracellular matrix, which is associated with stiffening of the arterial wall.

Methods: Aortas were dissected from 3 groups (RA, 10 patients; OA, 10 patients; healthy controls, 10 patients) to obtain rings of 4 to 6 mm in diameter. Rings were treated with hyaluronidase (10 mg/mL) and control medium. Rings were stretched to their pre-stretch length, and force was measured. Mechanical properties were analyzed using Moens-Kortweg equations. The results were analysed based on age, gender and aortic site, then compared with data obtained in living subjects using MRI (n = 160).

Results: At 100mmHg pressure, E of aortic rings increased with age, with a considerable increase in PWV: under 30 years = 3.73 ± 0.49; 30-39 years = 3.32 ± 0.58; 40-49 years = 3.32 ± 0.49; 50-59 years = 3.55 ± 1.00; 60-69 years = 4.05 ± 1.21; 70-79 years = 4.52 ± 1.26; 80-89 years = 5.99 ± 0.39 m/s. There was no significant difference in either E or PWV between genders. There was also no significant difference in E or PWV based on aortic site, likely due to under-representation of most sites.

PWV measured in vivo using MRI was higher at age: under 30 years = 3.96 ± 0.21; 30-39 years = 4.47 ± 0.61; 40-49 years = 4.85 ± 0.75; 50-59 years = 5.97 ± 1.14; 60-69 years = 6.64 ± 1.16; 70-79 years = 9.40 ± 4.24 m/s. The difference between in vivo and ex vivo measurements increased with age.

Conclusions: PWV calculated from ex vivo E measurements reflect established physiological patterns, suggesting that direct elastic modulus measurement could be an acceptable method for analysing stiffness in aortic tissue.

DURING EXERCISE CAROTID ARTERY WAVE INTENSITY ANALYSIS IN HEALTHY HUMANS

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Objective: To check of relation between blood pressure (BP) and arterial stiffness parameters and measures of left atrial volume to verify whether it is the arterial stiffness-related BP parameters or mean arterial pressure (MAP) that could be responsible for increase in risk of atrial fibrillation.

Methods: Group of Cracow suburban area inhabitants (n = 205, 66% women) was examined for: 24hSBP24h, DBP24h, MAP24h, central(cSBP, cDBP, cMAP, cPP), carotid-femoral pulse wave velocity (PWV), parameters of left ventricular mass (LVM, LVMII) and left atrial volume (LAV, LAVI). Anthropometric and clinical data were gathered via questionnaire. With division according to sex-stratified dichotomised LVMII (97g/m2 for women, 110g/m2 for men), correlation analysis was performed and further linear regression models were fitted to identify and assess respective value of steady and pulsatile BP components as factors related to left atrial volume measures.

Results: After subdivision of population, statistically significant correlations (p < 0.05) were identified only in persons below group-median value of LVMII. For LAV:SBP24h(r = 0.26), MAP24h, MAP24h, central(cSBP, cDBP, cMAP, cPP) BPs, carotid-femoral pulse wave velocity (PWV), parameters of left ventricular mass (LVM, LVMII) and left atrial volume (LAV, LAVI). Anthropometric and clinical data were gathered via questionnaire. With division according to sex-stratified dichotomised LVMII (97g/m2 for women, 110g/m2 for men), correlation analysis was performed and further linear regression models were fitted to identify and assess respective value of steady and pulsatile BP components as factors related to left atrial volume measures.

Conclusions: Mean arterial pressure is associated with greater left atrial volumes. The fact that relation is blunted in persons with greater LVMII, itself related more to MAP, shows importance of this particular form of target organ damage in relation to LAV.

ELASTIC MODULUS OF HUMAN AORTAS AS A MEASURE OF STIFFNESS

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Background: Although arterial stiffness is of clinical interest, data on the elastic modulus of the human aortic wall are scarce. The aim of this work is to directly measure the elastic modulus of human aorta ex vivo.

Methods: Using a standard tensiometer, we measured the elastic modulus (E) of human aortic rings (n = 205). Wall thickness and diameter were measured, and the pulse wave velocity (PWV) for each aorta was calculated using Moens-Kortweg equations. The results were analysed based on age, gender and aortic site, then compared with data obtained in living subjects using MRI (n = 160).

Results: At 100mmHg pressure, E of aortic rings increased with age, with a considerable increase in PWV: under 30 years = 3.73 ± 0.49; 30-39 years = 3.32 ± 0.58; 40-49 years = 3.32 ± 0.49; 50-59 years = 3.55 ± 1.00; 60-69 years = 4.05 ± 1.21; 70-79 years = 4.52 ± 1.26; 80-89 years = 5.99 ± 0.39 m/s. There was no significant difference in either E or PWV between genders. There was also no significant difference in E or PWV based on aortic site, likely due to under-representation of most sites.

PWV measured in vivo using MRI was higher at age: under 30 years = 3.96 ± 0.21; 30-39 years = 4.47 ± 0.61; 40-49 years = 4.85 ± 0.75; 50-59 years = 5.97 ± 1.14; 60-69 years = 6.64 ± 1.16; 70-79 years = 9.40 ± 4.24 m/s. The difference between in vivo and ex vivo measurements increased with age.

Conclusions: PWV calculated from ex vivo E measurements reflect established physiological patterns, suggesting that direct elastic modulus measurement could be an acceptable method for analysing stiffness in aortic tissue.

WHITE MATTER LESIONS ARE ASSOCIATED WITH A SIGNIFICANT DECREASE IN THE METABOLISM OF THE BRAIN GREY-MATTER FROM OLDER HYPERTENSIVE PATIENTS

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White matter lesions, described as leukoaraiosis, are frequently documented in older hypertensive patients, but their consequence on brain metabolism remains debated. This study aimed at characterizing the changes in brain metabolism, assessed by 18F-fluorodesoxyglucose Positron Emission Tomography (FDG-PET) imaging in relation to the severity of leukoaraiosis in older hypertensive patients.