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P11.09: SYSTEMIC ARTERIAL PROPERTIES IN WOMEN 3 YEARS AFTER A PRE-ECLAMPTIC PREGNANCY

M.E. Estensen, E.W. Remme, A. Swillens, T. Henriksen, O.A. Smiseth, L. Gullestad, P. Segers, S. Aakhus

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Results: As expected, clinic blood pressure values and media to lumen ratio were higher in essential hypertensive patients than in normotensive controls. Fibronectin media content was significantly greater in essential hypertensive patients ($7.41 \pm 2.28\%$), compared with normotensive controls (5.62 ± 0.40 , $P < 0.05$). A significant correlation was observed between fibronectin media content and media to lumen ratio ($r = 0.49$, $p < 0.05$). No significant difference in laminin media content was observed between groups ($3.7 \pm 1.71\%$ in essential hypertensive patients, $5.63 \pm 1.79\%$ in normotensive controls).

Conclusions: Our results indicate that, in small resistance arteries of patients with essential hypertension, fibronectin, but not laminin media content is increased. Fibronectin might be therefore involved in the development of small resistance artery remodeling in humans.

P11.07

DIFFERENCE BETWEEN SYSTOLIC AND DIASTOLIC CAROTID ARTERY STIFFNESS IS INDEPENDENTLY ASSOCIATED WITH LEFT VENTRICULAR MASS INDEX IN HEALTHY MIDDLE-AGED SUBJECTS

K. D. Reesink¹, E. Hermeling¹, S. J. Vermeersch², E. R. Rietzschel², M. L. De Buyzere², T. Gillebert², R. J. van de Laar¹, I. Ferreira¹, A. P. G. Hoeks¹, L. M. van Bortel², R. S. Reneman¹, P. Segers²

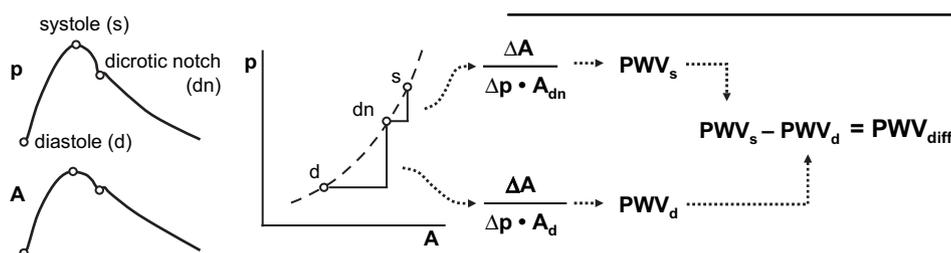
¹Maastricht University, Maastricht, Netherlands

²Ghent University, Ghent, Belgium

Background: Arterial stiffening potentially plays a role in cardiac hypertrophy. We recently demonstrated in patients that arterial stiffness can be substantially pressure dependent and, here, introduce a non-invasive measure to quantify the pressure dependence in the carotid artery, defined as the difference between systolic and diastolic pulse wave velocity (PWV_{diff}). Both PWV_{diff} and peripheral wave reflections (quantified by augmentation index, Alx) are biomechanically related to (late) systolic pressure increase. Therefore, we investigated the associations of PWV_{diff} and Alx with left ventricular mass index (LVMI).

Methods and Results: In 1522 subjects of the Asklepios cohort (age 35-55 yrs, healthy) PWV_{diff} was calculated from segmental distensibility coefficients, as obtained by carotid artery ultrasound and tonometry (Figure). PWV_{diff} ranged from 0.7 to 4.4 m/s. Linear regression analysis showed a significant association of PWV_{diff} with LVMI (β of $1.26 \text{ g/m}^{2.7}$ per m/s, 95% CI: 0.91-1.62), which remained significant after adjusting for covariates ($p = 0.03$). Alx showed no consistent association with LVMI.

Conclusions: Carotid PWV_{diff} is independently associated with left ventricular mass index in presumed healthy middle-aged subjects. Non-invasive carotid artery ultrasound and tonometry enable assessment of the contribution of pressure dependent stiffness to LV pressure load, independently of wave reflections.



P11.08

EVALUATION OF ARTERIAL STIFFNESS IN CHRONIC KIDNEY DISEASE (CKD) STAGE 2-5 BY PULSE WAVE MEASUREMENTS AND AMBULATORY ARTERIAL STIFFNESS INDEX (AASI)

L. Boesby¹, T. Elung-Jensen², S. Strandgaard¹, A. L. Kamper²

¹Department of Nephrology, Herlev Hospital, Herlev, Denmark

²Department of Nephrology, Rigshospitalet, Copenhagen, Denmark

Purpose: To study arterial stiffness in CKD by AASI compared to Augmentation Index (Alx) and aortic pulse wave velocity (aPWV). To study the intra-patient reproducibility of AASI in CKD.

Methods: Patients were studied 2 days within 2 weeks. Double applanation tonometry recordings of the radial pressure wave form and aPWV and 24-h ambulatory blood pressure measurements were done. AASI was calculated as 1 minus the regression slope of diastolic over systolic blood pressure. CKD stage was determined by estimated glomerular filtration rate. Spearman's correlation coefficient (SCC) was used for evaluating correlations. Day-to-day reproducibility was evaluated by the intra-class correlation coefficient (ICC).

Results: 68 patients (M50:F18), median age 63 years (range 30-79), with CKD stage 2 (n=17), stage 3 (n=22), stage 4 (n=20) and stage 5 (n=9) were studied. Mean (\pm SD) AASI was 0.44 ± 0.15 , mean Alx was $28.2\% \pm 10.4\%$ and mean aPWV was $9.4 \text{ m/s} \pm 1.0 \text{ m/s}$ with no significant differences among the stages. The SCC between AASI and Alx was 0.320 ($P = 0.01$), between AASI and aPWV it was 0.643 ($P < 0.0001$) and between Alx and aPWV it was 0.346 ($P = 0.006$). ICC_{AASI} was 0.755 (95% CI: 0.630-0.841) with even greater reproducibility in CKD stages 4-5 ($ICC > 0.860$).

Conclusions: The observed values of AASI in CKD patients were similar to those reported for the background population, while Alx and aPWV were higher. Despite good correlations between these parameters, the normal values of AASI found in the present study preclude its use as an index of vascular stiffness in CKD. Intra-patient reproducibility of AASI in CKD stage 2-5 was high.

P11.09

SYSTEMIC ARTERIAL PROPERTIES IN WOMEN 3 YEARS AFTER A PRE-ECLAMPTIC PREGNANCY

M. E. Estensen^{1,5}, E. W. Remme², A. Swillens³, T. Henriksen⁴, O. A. Smiseth⁵, L. Gullestad⁵, P. Segers³, S. Aakhus⁵

¹National Resource Centre for Women's Health, Oslo University Hospital, Rikshospitalet, Oslo, Norway

²Institute for Surgical Research, Oslo University Hospital, Rikshospitalet, Oslo, Norway

³IBiTech, Ghent University, Ghent, Belgium

⁴Department of Obstetrics, Oslo University Hospital, Rikshospitalet, Oslo, Norway

⁵Department of Cardiology, Oslo University Hospital, Rikshospitalet, Oslo, Norway

Purpose: Pre-eclampsia is defined by hypertension and proteinuria, occurs in 3-10% of all pregnancies. The pathophysiological adaptation of systemic arterial properties has not been described. We performed a comprehensive study of systemic arterial properties in women with previous pre-eclamptic pregnancy (PPEP) as compared to women with previous normal pregnancy (PNP).

Methods: 35 women (37 ± 4 years) with PPEP (3.5 ± 1.0 years) and 65 (33 ± 1 years) with PNP (6 months postpartum), were studied. Aortic root pressure and flow were obtained by calibrated right subclavian artery pulse trace, and aortic annular Doppler blood flow recordings. Systemic arterial properties were described by total arterial compliance (C), arterial elastance (Ea), characteristic impedance (Z₀), and peripheral arterial resistance (R). Wave reflection was assessed as the ratio of the magnitude of the backward (P_b) to

forward (P_f) pressure wave. Parameters were estimated by Fourier analysis of central aortic pressure and flow data and methods based on the 2-element windkessel model.

Results: (Table) Women with PPEP had significantly higher blood pressure than PNP. R was not significantly different between the groups, but Z₀ and Ea were significantly higher, and C trended lower in the PPEP group. There was significantly higher amplitude in both forward and backward.

Conclusions: The higher blood pressures in women with PEP is not explained by higher peripheral arterial resistance, but is likely related to a stiffer proximal aorta, and lower arterial compliance. This may relate to the higher risk for later cardiovascular events observed in women with PEP.

| | PPEP | PNP | P |
|--|------------|-----------|--------|
| Mean arterial pressure (mmHg) | 102±17 | 86±8 | <0.001 |
| Systolic pressure (mmHg) | 129±21 | 110±9 | 0.002 |
| Heart rate (min ⁻¹) | 70±7 | 66±7 | 0.011 |
| Cardiac output (l min ⁻¹) | 5.5±1.2 | 4.9±0.9 | 0.020 |
| R (mmHg ml ⁻¹ s ⁻¹) | 1.16± 0.31 | 1.10±0.29 | 0.295 |
| Z ₀ (10 ³ -mmHg ml ⁻¹ s ⁻¹) | 72±30 | 55±22 | 0.004 |

(continued)

| | PPEP | PNP | P |
|------------------------------------|-----------|-----------|-------|
| C WK (ml mmHg ⁻¹) | 1.28±0.42 | 1.40±0.45 | 0.239 |
| C PPM (ml mmHg ⁻¹) | 1.03±0.33 | 1.14±0.30 | 0.104 |
| Ea (mmHg ml ⁻¹) | 1.45±0.39 | 1.27±0.28 | 0.004 |
| Amplitude Forward Wave (Pf; mmHg) | 36±9 | 30±6 | 0.001 |
| Amplitude Backward Wave (Pb; mmHg) | 22±8 | 19±4 | 0.017 |
| Reflection magnitude (Pb/Pf) | 0.60±0.13 | 0.64±0.13 | 0.145 |

Mean±SD. $p < 0.05$ (unpaired t-test). WK = C obtained using windkessel model fit; PPM = pulse pressure method.

P11.10

ARTERIAL STRUCTURE AND FUNCTION ARE INFLUENCED BY ANTIRETROVIRAL THERAPY AND BY THE PRESENCE OF RENAL DAMAGE IN HIV POSITIVE PATIENTS

F. Cesana¹, A. Maloberti¹, M. Pozzi¹, M. Corciulo¹, G. Grosso¹, D. Dozio¹, F. Citterio¹, M. Alloni¹, S. Nava¹, M. Stucchi¹, A. Capra^{1,2}, C. Giannattasio^{1,2}, G. Mancina^{1,2}

¹University of Milan Bicocca, Department of Clinical Medicine and Prevention, Monza, Italy

²Clinica Medica, San Gerardo Hospital, Monza, Italy

Purpose: Antiretroviral therapy (ART) has dramatically reduced AIDS-related mortality, but it has been associated to an increased cardiovascular risk, even in absence of hypertension. The aim of this study was to describe the influence of renal damage (RD) and ART on arterial function and structure.

Methods: We studied 4 groups of normotensive, normocholesterolemic, euglycemic patients; one of HIV+ on ART with RD (A; n=25; age 50.2±10.4 years; means±SD), one of HIV+ on ART without RD (B; n=25; 49.4±6.2 years), one of HIV+ not on ART and without RD (C; n=13; 40±8.3 years) and one of healthy controls (D; n=25; 50±6.8 years). RD was defined by microalbuminuria and/or eGFR < 60 ml/min. Arterial stiffness was measured by aorto-femoral Pulse Wave Velocity (PWV), central BP by tonometry (Sphygmocor), carotid IMT and distensibility were measured by semi-automatic echotracking.

Results: Group A showed higher aortic SBP and PP than other groups and their aortic SBP was not significantly different from systemic one. PWV was higher in both therapy groups compared to others. Aortic distensibility was significantly impaired in A compared to B and C groups (no data for D group). IMT didn't show any difference among groups.

Conclusions: HIV+ patients are characterized by arterial functional abnormality that might account for their increased cardiovascular risk due to either ART and/or presence of RD.

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P12.01

LOCAL CAROTID STIFFNESS VERSUS CAROTID-FEMORAL PULSE WAVE VELOCITY IN NORMAL SUBJECTS AND PATIENTS WITH RISK FACTORS

G. Bini¹, C. Morizzo¹, N. Guraschi², E. Malshi¹, M. Kozakova¹, C. Palombo¹

¹Department of Internal Medicine, University of Pisa, Pisa, Italy

²Esaote SpA, Florence, Italy

Aim of this study was to compare a local carotid pulse wave velocity (C-PWV) measured by high resolution radiofrequency (RF) ultrasound (Q-AS®, Esaote) with carotid-femoral PWV (CF-PWV, Complior), and their relationships with age and BP in normal subjects and in patients (ABN) with risk factors and/or atherosclerotic clinical disease (CVD).

We studied 64 subjects (37 men and 27 women, mean age 49 ±15, BP 124±19/73±9 mmHg), including 33 NL and 31 ABN. Arterial distension curves were obtained by averaging 15 parallel RF-lines obtained with a 10 MHz linear probe through a 1-cm long ROI in CCA. Local carotid stiffness index was calculated after introducing BP values, and C-PWV was obtained by Bramwell-Hill's equation.

Results: C-PWV in both sides and CF-PWV obtained in the overall population and separately in NL and ABN are shown in Table:

| | Carotid PWV (right) (m/s) | Carotid (left) PWV (m/s) | CF-PWV (m/s) |
|--------------|---------------------------|--------------------------|--------------|
| ALL SUBJECTS | 7.6±2.1 | 7.5±2.0 | 8.5±1.6* |
| NORMALS | 6.2±1.1 | 6.2±1.0 | 7.9±1.5* |
| ABNORMALS | 8.5±1.1 | 8.8±1.8 | 9.1±1.6 |

*: $p < 0.01$ for CF-PWV vs local C-PWV.

In the whole population, C-PWV and CF-PWV correlated directly ($p < 0.0001$) with age ($r = 0.82$ and $r = 0.61$ respectively) and SBP ($r = 0.72$ and $r = 0.64$). In multivariate analysis age was the strongest independent predictor of C-PWV (partial $R^2 = 0.67$), followed by SBP (cumulative $R^2 = 0.82$). By contrast, SBP was the best predictor of CF-PWV (partial $R^2 = 0.41$), followed by age (cumulative $R^2 = 0.55$). Similar results were obtained after introducing sex, risk factors and CVD as covariates. Conclusions: compared to CF-PWV, local C-PWV shows a stronger association with age and results significantly lower in normal subjects but not in patients with risk factors or CVD.

P12.02

RELATIONSHIP BETWEEN IMPAIRED LUNG FUNCTION AND CARDIAC FUNCTION IN OLDER INDIVIDUALS

B. J. McDonnell¹, I. Munnery², M. Munnery², C. Bolton², I. B. Wilkinson³, C. M. McEnery³, J. R. Cockcroft²

¹Cardiff School of Health Sciences, University of Wales Institute, Cardiff, Cardiff, United Kingdom

²Wales Heart Research Institute, Cardiff University, Cardiff, United Kingdom

³United pharmacology Unit, University of Cambridge, Cambridge, United Kingdom

Background: Impaired lung function is associated with increased cardiovascular (CV) risk although the underlying mechanisms remain unclear. We have previously shown that lung function is inversely related to arterial stiffness in older men, and that patients with chronic obstructive pulmonary disease (COPD) have increased arterial stiffness. Furthermore, arterial stiffness is associated with impaired diastolic function in individuals with COPD. Our aim was therefore to examine the relationship between cardiac function and lung function in a population-based cross-sectional study.

Methods: Data from 1026 individuals, aged between 50-92 years, from the Anglo Cardiff Collaborative Trial, were available for the current analyses. Spirometry was performed (Vitalograph) to assess the degree of airways obstruction by measuring forced expiratory volume in 1 second: forced vital capacity ratio (FEV1:FVC). Peripheral blood pressure was recorded (Omron 711) in the supine position according to BHS guidelines. Cardiac function was assessed by measuring stroke volume (SV), using a non-invasive, inert gas re-breathing technique (InnoCor, Innovision A/S, Denmark).

Results: After entering all confounding factors of FEV1:FVC ratio (age, height, gender, smoking status, body surface area, heart rate, peripheral vascular resistance and mean arterial pressure) into a stepwise multivariate linear regression model, SV remained independently related to lung function ($R = 0.28$, $P = 0.025$).

Discussion: Stroke volume is independently associated with impaired lung function in this population based study, suggesting a mechanism whereby impaired lung function may increase CV risk. Increased arterial stiffness, which is associated with impaired lung function, may be an important mechanism mediating the relationship between cardiac function and lung function.

P12.03

RELATIONSHIP OF COMMON CAROTID ARTERY WAVE INTENSITY WITH AGE AND SEX IN HEALTHY NORMOTENSIVE PEOPLE

C. M. Park, J. E. Davies, S. Curtis, S. A. M. Thom, J. Mayet, K. H. Parker, A. D. Hughes

Imperial College London, London, United Kingdom

Background: Wave intensity analysis (WIA) is a time domain-based approach [1] that provides useful insights into arterial haemodynamics. We assessed the relationship between the major waves identified by WIA and age and sex in healthy individuals.

Methods: 65 healthy people (age 21 – 78yr; 43 male) participated. WIA was performed using carotid artery tonometry and Doppler ultrasound. Linear regression or fractional polynomial regression was used to fit data after log transformation if appropriate.

Results: The initial compression wave (S wave) accompanying ejection declined non-linearly with age (adjusted r^2 for age and sex = 0.43; $p < 0.001$) and was significantly lower in women ($p = 0.01$). The decompression wave in protodiastole (D wave) showed a curvilinear relationship with age (adjusted r^2 for age 0.12; $p = 0.001$), but did not differ by gender. The peak intensity of the reflected wave from the head was higher in men ($p = 0.002$) but declined with age more markedly in men than women. Wave reflection from the head fell with age (beta (95% CI) = -0.01 (-0.02, -0.00); $p = 0.01$ (log transformed)) but did not differ significantly by gender.