



## Artery Research

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### **P5.11: EFFECT OF CAROTID BARORECEPTOR ACTIVATION ON VENTRICULAR FUNCTION AND CENTRAL ARTERIAL HEMODYNAMICS: A CASE REPORT BASED ON INVASIVE PRESSURE-VOLUME LOOP ANALYSIS**

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(twice), at 30 and at 75min post glucose intake. FMD was defined as the peak increase in diameter relative to baseline diameter ( $\Delta D_{\text{peak}}/D_{\text{baseline}}$ ) and as the response/stimulus ratio:  $\text{nFMD} = \text{FMD}/(\Delta \text{WSS}_{\text{mean}}/\text{WSS}_{\text{baseline}})$ . Subjects underwent this protocol twice, resulting in four baseline FMD measurements to estimate intra-class correlation coefficients, which were 0.57 and 0.63 for nFMD and FMD, respectively.

**Effect of the oral glucose tolerance test: Comparison between nFMD and FMD**

	baseline	30min	75min	p-value*
glucose [mmol/l]	4.7 ± 0.3	6.6 ± 1.0	5.9 ± 1.3	<0.001
nFMD [a.u.]	0.072 ± 0.056	0.029 ± 0.019	0.037 ± 0.035	0.001
FMD [%]	6.3 ± 2.7	5.1 ± 3.0	5.9 ± 3.4	0.068

\*repeated ANOVA, n=22.

**Conclusions:** With nFMD, glucose induced changes in flow mediated dilation are better discriminated than by  $\Delta D_{\text{peak}}/D_{\text{baseline}}$ . These findings demonstrate the merit of stimulus normalisation in vascular intervention studies.

#### P5.09

##### AORTIC/PENILE INDEX IS A MARKER OF OCCULT CORONARY ARTERY DISEASE IN MIDDLE-AGED HYPERTENSIVE PATIENTS WITH ERECTILE DYSFUNCTION

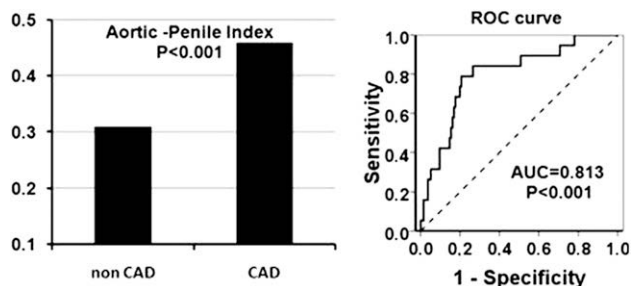
N. Ioakeimidis, C. Vlachopoulos, D. Terentes-Printzios, P. Xaplanteris, E. Christoforatos, P. Pietri, D. Kardara, A. Synodinos, K. Aznaouridis, C. Stefanadis

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**Background:** It has been reported that there is a strict correlation between hypertension, erectile dysfunction (ED) and coronary artery disease (CAD), but the importance of an index to predict CAD in hypertensive ED patients needs to be addressed.

**Methods:** 155 consecutive asymptomatic non-diabetic treated hypertensive ED patients (40-60 y/o) were evaluated using exercise treadmill test and stress echocardiography. Men with positive one or both of the two tests were referred for coronary angiography in order to document CAD. All patients underwent penile Doppler ultrasonography and carotid-femoral pulse wave velocity (PWV) evaluation. Reduced penile peak systolic velocity (PSV) is associated impaired penile arterial function and increased atherosclerotic burden. Aortic/penile index (API) was developed to describe the severity of extracoronary vascular dysfunction with the formula:  $\text{API} = \text{PWV}/\text{PSV}$ .

**Results:** Coronary angiography revealed stenotic lesions in 19 (12%) patients. The prevalence of Grade II/III hypertension was not different between CAD patients and subjects without CAD. CAD patients compared to subjects without CAD had higher PWV (9.3 vs 8.6 m/s,  $P < 0.01$ ), lower PSV (23 vs 30 cm/s,  $P < 0.01$ ) and a higher API (left figure). Right figure illustrates the diagnostic performance of API for CAD prediction. Further analysis revealed that the area under the curve (AUC) for API was significantly greater than the AUC for either parameter alone (all  $P < 0.05$ ). **Conclusions:** API allows an accurate interpretation for the interrelationships between hypertension, ED and CAD and predicts CAD with high values of both sensitivity and specificity. Our findings allow identification of hypertensive men who might warrant more intensive follow-up.



#### P5.10

##### DISSOCIATION OF CARDIAC REMODELLING AND AORTIC STIFFNESS INDICES AS OF CARDIAC/VASCULAR RISK, AND THEIR RELATIONSHIP TO VITAMIN D3

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**Aims:** To investigate if concentric cardiac remodelling is related to central aortic Pulse Wave Velocity (aPWV) and to circulating vitamin D3, in men of different ethnic groups and cardiac/vascular risk.

**Methods:** Community samples of 194 men, Afro-Caribbean (n=64, age: 54±10yr) at higher stroke but lower CHD risk, South Asian (n=68, 55±10yr) at high CHD risk and European (n=62, 57±9yr), reference risk, had standard echocardiographic LV geometry measurements, and aPWV by Arteriograph. In a sub-sample of 48, these indices were also measured by cardiac MR.

**Results:** Concentric geometry quantified as relative wall thickness ( $\text{RWT} > 0.42$ ) was commoner among AfC (59%) and SA (49%) than Europeans (24%) ( $p < 0.001$ ). RWT was by 0.05(0.01) higher in SA and AfC than in Europeans, as was Mass/Volume by MR. Mean(SE) 25(OH)D3 in SA and AfC was 21(3) and 14(3) nmol/L < Europeans. In regression models, adjusting for age, systolic blood pressure (BP), diabetes and BMI, 25(OH)D negatively correlated with indices of left ventricle (LV) concentric geometry (RWT) by echocardiography. A 1SD (18 nmol/L) rise in 25(OH)D predicted a 0.23 SD drop in RWT ( $p = 0.002$ ). Adjusted for age, SBP and diabetes, 25(OH)D was also inversely related to aPWV, (B(SE)) = -0.013(0.004),  $p < 0.001$ . However, RWT & aPWV were poorly if 'significantly' correlated ( $r = 0.18$ ,  $p = 0.01$ ) & not in the smaller MR sample.

**Conclusions:** vitamin D status in AfC and SA compared to European men was negatively associated with both LV concentric remodelling and aPWV, although cardiac geometry and aPWV were poorly related themselves. Vitamin D intervention trials are required.

#### P5.11

##### EFFECT OF CAROTID BARORECEPTOR ACTIVATION ON VENTRICULAR FUNCTION AND CENTRAL ARTERIAL HEMODYNAMICS: A CASE REPORT BASED ON INVASIVE PRESSURE-VOLUME LOOP ANALYSIS

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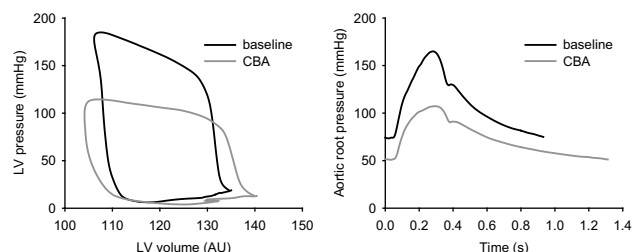
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**Background:** Carotid baroreceptor activation (CBA) is being explored as anti-hypertensive therapy in patient with resistant hypertension. In this study, we demonstrate the effect of CBA on cardiac performance and central arterial hemodynamics based on invasive data measured in a 78 year old male patient with resistant hypertension who also showed clinical symptoms of heart failure. **Materials and methods** Measurements were performed upon implantation of a CBA device (CVRx, Minneapolis, Mn), with a pressure-volume catheter inserted via the groin and advanced into the left ventricle (LV). Pressure-volume loops were acquired at baseline and with CBA (Figure-left). Upon catheter pullback, pressure recordings were made (baseline and CBA) in the aortic root (Figure-right). A flow waveform was derived from the volume data, and combined with the aortic root pressure to assess wave reflection via wave decomposition.

**Results:** CBA slowed heart rate from 64 to 46 bpm, reduced central systolic (from 165 to 107 mmHg) and pulse (92 to 56 mmHg) pressure, while stroke volume increased by about 30%. The LV end-diastolic pressure-volume relation was lowered (Figure-left), reducing end-diastolic pressure from about 19 to 13 mmHg. CBA lowered characteristic impedance by 40%, leading to a similarly large reduction in forward pressure wave amplitude (from 90 to 56 mmHg). Backward wave amplitude was lowered from 31 to 23 mmHg. **Conclusions** This in vivo case report demonstrates not only profound favourable effects of CBA on LV afterload, but a concomitant effect on LV filling dynamics which might particularly be important in patients with heart failure.



**P5.12**  
**ARTERIAL STIFFNESS, WAVE REFLECTIONS AND PULSE PRESSURE AMPLIFICATION IN METABOLIC SYNDROME**

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**Background:** the metabolic syndrome (MetS), an important contributor of insulin resistance and cardiovascular risk, is defined by three or more of the following clinical characteristics: abdominal obesity, hyperglycemia, hypertension, hypertriglyceridemia and hypo-HDL-cholesterolemia.

**Aim:** to review the existing data regarding the effect of MetS on peripheral and central blood pressure, stiffness and wave reflections.

**Results:** Increased aortic stiffness, a major mechanical factor predicting cardiovascular risk, is identified as participating to MetS. Its age-progression rate is proportional to the number of risk factors involved in MetS. Aortic stiffening with age is partly responsible for increased systolic blood pressure (SBP) and decreased diastolic blood pressure (DBP), the dominant hypertension phenotype in the elderly, which favors cardiac hypertrophy and coronary ischemia. Both parameters participate in the definition of pulse pressure (PP = SBP-DBP), which is of major importance in prognosis of subjects with MetS. Of note, beyond that of peripheral brachial parameters, central hemodynamic parameters associate to increased arterial stiffness reduced wave reflections and increased PP amplification, mainly attributed to enhanced heart rate. The latter findings are in the opposite direction than the one observed in essential hypertension in the absence of insulin resistance.

**Conclusion:** A diverging behavior of wave reflections and pulse pressure amplification, but not of arterial stiffness, is observed between hypertension alone and MetS. This might explain epidemiological findings on the reduced predictive value of MetS in the elderly and justify long term longitudinal studies relating central hemodynamics and mortality.

**P5.13**  
**ALKALINE PHOSPHATASE AND ARTERIAL STRUCTURE AND FUNCTION IN HYPERTENSIVE AFRICAN MEN: THE SABPA STUDY**

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**Background:** Vascular calcification is believed to be due to the conversion of vascular smooth muscle cells into osteoblast-like cells and is associated with mortality. Since hypertension and related mortality in Africans is a concern, we investigated associations between a marker of osteoblastic activity, alkaline phosphatase (ALP), and measures of arterial structure and function in hypertensive African men.

**Methods:** This study included 79 hypertensive African men. We conducted 24h ambulatory blood pressure and carotid intima-media thickness (cIMT) measurements. The cIMT was obtained with an intra-observer variability of 0.04 mm and the cross-sectional wall area (CSWA) was calculated. ALP was measured in serum.

**Results:** ALP was within its reference range (101.6 vs. 30.0–120.0 U/L), however cIMT was higher compared to gender and age-specific reference values i.e., 25 to 40 years (0.63 vs. 0.43–0.53 mm), 40 to 50 years (0.71 vs. 0.50–0.61 mm) and older than 50 years (0.84 vs. 0.53–0.70 mm). In single and partial regressions, and confirmed with multiple regression analyses, 24h systolic blood pressure ( $R^2=0.304$ ,  $\beta=0.299$ ,  $p=0.011$ ), 24h pulse pressure ( $R^2=0.318$ ,  $\beta=0.398$ ,  $p<0.001$ ), but not 24h diastolic blood pressure ( $R^2=0.164$ ,  $\beta=0.078$ ,  $p=0.54$ ), were positively associated with ALP. In addition, cIMT ( $R^2=0.393$ ,  $\beta=0.302$ ,  $p=0.008$ ) and CSWA ( $R^2=0.409$ ,  $\beta=0.255$ ,  $p=0.023$ ) also correlated positively with ALP after adjusting for significant covariates, and after excluding participants with diabetes and renal dysfunction.

**Conclusion:** Serum alkaline phosphatase in hypertensive African men is adversely associated with measures of arterial structure and function, independent of diabetes and renal dysfunction.

**P5.14**  
**ARTERIAL STIFFNESS IS ASSOCIATED WITH THE SEVERITY OF ATHEROSCLEROSIS AND SERUM OSTEOPONTIN LEVELS IN PATIENTS WITH SYMPTOMATIC PERIPHERAL ARTERIAL DISEASE**

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**Background:** Arterial stiffness is an independent predictor of vascular morbidity and mortality in the general population and in high-risk patients. Angiographic score (ASc) is closely related to the extent of atherosclerosis in patients with peripheral arterial disease (PAD). Osteopontin (OPN) is involved in the pathogenesis of atherosclerosis. The aim of the present study was to evaluate the association between arterial stiffness, ASc, and serum OPN in patients with symptomatic peripheral arterial disease.

**Methods:** Seventy-nine male patients with symptomatic PAD (mean age 64±7 years) were included into this study. The diagnosis of PAD was confirmed by ankle-brachial pressure index (ABPI) and digital subtraction angiography. Calculation of the ASc was based on the severity and location of atherosclerotic lesions in the lower extremity arteries. Aortic pulse wave velocity (aPWV) was evaluated by applanation tonometry using the Sphygmocor device. OPN level was determined by an enzyme-linked immunosorbent assay.

**Results:** The aPWV was significantly correlated with ASc ( $r=0.35$ ,  $p=0.002$ ), OPN ( $r=0.34$ ,  $p=0.004$ ), estimated glomerular filtration rate (eGFR) ( $r=-0.36$ ,  $p=0.002$ ), age ( $r=0.4$ ,  $p<0.001$ ), and mean arterial pressure (MAP) ( $r=0.24$ ,  $p=0.04$ ). In multivariate analysis, aPWV was independently associated with ASc, OPN, MAP and eGFR ( $R^2=0.43$ ,  $p<0.001$ ). Serum OPN was inversely correlated with ABPI ( $r=-0.26$ ,  $p=0.045$ ) but not with ASc.

**Conclusion:** In patients with symptomatic PAD, arterial stiffness is independently associated with the severity grade of atherosclerotic disease and serum OPN levels. These results suggest that aPWV might serve as a useful clinical marker of atherosclerosis in patients with PAD.

**P5.15**  
**THE INFLUENCE OF THE MEAN BLOOD PRESSURE ON ARTERIAL STIFFNESS PARAMETERS IN RHEUMATOID ARTHRITIS AND SYSTEMIC LUPUS ERYTHEMATOSUS WOMEN**

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**Introduction:** The increased prevalence of premature atherosclerosis and stiffening of arteries in patients with rheumatoid arthritis (RA) and systemic lupus erythematosus (SLE) is well established.

However, it is uncertain which of risk factors has the greatest influence on arterial stiffness parameters from applanation tonometry.

**Methods:** 63 women with RA, 31 with SLE and 72 controls aged 18-55 years were examined. Parameters of arterial stiffness, augmentation index (AIx) and carotid-radial pulse wave velocity (PWV), were obtained by applanation tonometry (Sphygmocor (v.7.01) AtCor Medical).

**Results:** Women with RA and SLE differed from controls with respect to AIx ( $p<0.001$ ;  $p=0.008$ ) and did not differ between each other. SLE women differed from controls with respect to PWV ( $p=0.018$ ) while RA - did not. By multiple regression analysis we have found that main explanatory factor for AIx and PWV was mean blood pressure (MBP) in RA patients. In SLE women PWV was not related to any of the pending parameters, AIx - to organ damage index, age and MBP.

**Conclusion:** The mean blood pressure was the major and the only one risk factor on arterial stiffening in rheumatoid arthritis while the disease damage index played the most important role in systemic lupus erythematosus group. Mean blood pressure in systemic lupus erythematosus was not as important as in rheumatoid arthritis group, though may have partial influence.