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### **P.087: PULSE PRESSURE, AUGMENTATION INDEX AND PULSE WAVE VELOCITY IN SEVERE CARDIOMYOPATHY – IMPLICATIONS FOR RISK STRATIFICATION**

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## P.083

## THE INCREMENTAL EFFECT OF OBSTRUCTIVE SLEEP APNEA SYNDROME ON ARTERIAL STIFFNESS IN NEWLY DIAGNOSED ESSENTIAL HYPERTENSIVE SUBJECTS

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**Objective:** Although obstructive sleep apnea syndrome (OSAS) is accompanied by increased atherosclerotic cardiovascular disease burden, its relation with arterial stiffness is not yet well determined. We investigated whether essential hypertensive subjects with OSAS are characterized by increased arterial stiffness.

**Methods:** Our study population consisted of 46 consecutive subjects with newly diagnosed untreated stage I-II essential hypertension suffering from OSAS (35 men, aged 49±8 years) and 53 hypertensive subjects without OSAS, matched for age, sex, and smoking status. All subjects underwent polysomnography, echocardiography and aortic stiffness evaluation by means of carotid-femoral pulse wave velocity (c-f PWV) measurements.

**Results:** Hypertensives with OSAS [apnea hypopnea index (AHI) ≥5] compared to hypertensives without OSAS (AHI < 5), demonstrated increased levels of body mass index (31.4±4 vs 29.3±4 kg/m<sup>2</sup>, p=0.015), office systolic/diastolic blood pressure (BP) (151/99 vs 145/94 mmHg respectively, p<0.05, for both cases) and relative wall thickness (0.46±0.06 vs 0.42±0.07, p=0.010). Hypertensives with OSAS compared to those without OSAS had significantly increased c-f PWV by 9% (8.56±0.49 vs 7.85±0.93 m/s, p=0.001) and this difference remained significant even after adjustment for confounders (p=0.04). In the total study population, c-f PWV was correlated with age (r=0.35, p=0.015), office systolic BP (r=0.30, p=0.007), relative wall thickness (r=0.30, p=0.03), logAHI (r=0.389, p=0.0001) and minimum oxygen saturation (minSatO<sub>2</sub>) (r=-0.418, p=0.0001).

**Conclusions:** OSAS has a significant incremental effect on aortic stiffening in the setting of middle-aged essential hypertensive subjects. This finding suggests that the presence of OSAS in a hypertensive patient accelerates vascular damage, increasing cardiovascular risk.

## P.084

## VARIATIONS OF INTIMA MEDIA THICKNESS DURING CARDIAC CYCLE

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The measurement of intima media thickness (IMT) of the common carotid artery has become very popular over the last decade. The IMT is regarded as a marker for atherosclerosis. A large number of studies are conducted with IMT as study endpoint.

In this study, with two ultrasound methods, it will be shown that IMT varies with blood pressure. In the first method, a sequence of 68 common carotid artery B-mode echo images covering 3 heartbeats was stored and analyzed with dedicated software. In each image the vessel diameter and the IMT of the far wall was determined. In the second method, the RF signal of M-mode echography of the same vessel segment of the same individual was used for wall tracking technique during 3 heartbeats. The time course of the diameter of the artery and the IMT of the far wall were determined.

During diastole IMT was thicker compared to systole. The cyclic variations of IMT and diameter were out of phase. Eliminating the time course revealed that IMT and diameter correlates highly and negatively. The difference of IMT could be as large as 10% of the average IMT value. Results were explainable with incompressible material during stretching.

These results underline the importance to define at what moment during the cardiac cycle the IMT measurement is done. More accurately the absolute blood pressure on the moment IMT is determined, is of great influence. Studies that omit this information contain a methodological flaw.

## P.085

## ACUTE EFFECT OF VOLUME EXCHANGE ON CENTRAL HEMODYNAMICS IN PERITONEAL DIALYSIS

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**Introduction:** Although peritoneal dialysis (PD) is considered favorable regarding hemodynamic stability, little is known on potential acute effects of fluid exchange. We aimed to assess central hemodynamic changes during infusion and dwell time.

**Methods:** Patients were randomized to 3 different starting volumes (1000, 1500 and 2500 mL) of the non-glucose containing icodextrin, followed by addition or drainage of 200 mL every 10 minutes for 50 minutes. Hemodynamic parameters were studied using the SphygmoCor, before and after infusion of the starting volumes and after each volume change. Local

carotid systolic blood pressure (BP), augmentation index (AI) and central augmentation pressure (AP) and were used as central measures.

**Results:** We included 13 patients (9 male, 4 female) on PD aged 57 years (range: 40-82) and with a median BP of 126/77 mmHg (range: 94-200/51-94 mmHg). After infusion of the starting volume, central systolic BP and central AP increased by 4.7 mmHg (p=0.006) and 2.8 mmHg (p=0.005). AI increased by 5.7% (p=0.04) and heart rate decreased by 2.6 bpm (p=0.006). The difference in heart rate adjusted AI was not significant. Intraperitoneal pressure increased by 2.3 cm H<sub>2</sub>O (p=0.03). No significant changes were observed on subsequent addition or drainage of volumes.

**Conclusions:** Infusion of PD fluids causes a significant acute increase in central systolic BP that persists for at least one hour and is associated with a slight decrease in heart rate. This may be due to an enhanced preload from intraperitoneal venous compression and/or to an increased wave reflection.

## P.086

## EVALUATION OF ARTERIAL DISTENSIBILITY IN HYPERTENSIVE PATIENTS TREATED WITH IRBESARTAN

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**Introduction:** The aim of the study is to evaluate the improvement of arterial distensibility by means of: (1) decrease of pulse wave velocity (PWV); (2) decrease of SBP and PP; and (3) decrease of Blood Pressure (BP), using an Angiotensin-II receptor antagonist, Irbesartan.

**Material and Methods:** 97 hypertensive patients, of which 43 (45.7%) were men, who attended their primary care centres two times. Mean age was 55 (SD ±10) in men and 62 (SD ±11) in women. All patients had their BP checked with a mercury sphygmomanometer, and their PWV measured with an automatic device, Complior, which registers in two different points (carotid and femoral arteries). Both measurements were taken at the initial appointment and at the six months follow up.

Appointment	SBP		DBP		CF		PP		PWV	
	A1	A2	A1	A2	A1	A2	A1	A2	A1	A2
Minimum	124	111	62	62	52	55	36	40	8	7.68
Maximum	200	176	110	94	104	104	106	95	21	21.51
Mean	157.66	140.3	92.3	81.84	77.79	79.02	65.36	58.46	12.29	11.46
SD	16.01	13.36	9.09	7.82	10.58	11.65	16.45	12.62	2.9	3.1

**Results:** there was a decrease in SBP, Diastolic Blood Pressure (DBP), PP, and PWV. A significant relation between the decrease of PWV and the decrease of the SBP was found.

**Conclusions:** (1) The PWV can be a valid indirect method to measure the arterial elasticity decrease in clinical practice, and (2) The use of drugs that act directly on the renin-angiotensin system (Irbesartan) can be useful in improving such elasticity.

## P.087

## PULSE PRESSURE, AUGMENTATION INDEX AND PULSE WAVE VELOCITY IN SEVERE CARDIOMYOPATHY - IMPLICATIONS FOR RISK STRATIFICATION

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**Background:** Pulse Pressure (PP), Augmentation Index (Alx), and Pulse Wave Velocity (PWV) are directly and positively associated with cardiovascular risk. However, in heart failure patients, an association between a lower PP and a worse outcome has been reported as well.

**Methods:** We measured Alx, using applanation tonometry (SphygmoCor) in 53 patients with severe cardiomyopathy (CMP) and 106 controls matched for age, gender, and diastolic blood pressure. All patients underwent coronary angiography for suspected coronary heart disease. In a subgroup (14 patients, 28 controls), we assessed PWV during catheter pullback.

**Results:** Mean age was 63.3 vs 63.6 years, ejection fraction (EF) was 28 vs 68% in patients vs controls, respectively. Central (but not peripheral) PP (32 vs 37 mmHg, p=0.01) and Alx (16 vs 23, p=0.001) were lower, ejection duration was shorter (260 vs 308 msec, p<0.00001) in patients, as compared to controls. When we subdivided the CMP patients with respect to Alx, those below the median had more advanced systolic dysfunction. In multiple regression analysis, EF was an independent predictor of Alx. PWV did not differ between patients and controls (7.8 m/s each group, p=0.99).

**Conclusions:** For the same level of DBP, cardiomyopathy patients show significantly lower central PP and Alx, but no difference in PWV, as compared

to controls. Therefore, a low EF, an important prognostic determinant, is not (PWV) or even inversely (central PP, Alx) represented by these measures of arterial function. When they are used for risk stratification, knowledge of systolic function is required as well.

#### P.088

##### INTENSIVE MEDICAL THERAPY NORMALISES FLOW-MEDIATED VASODILATATION AND INTIMA-MEDIA THICKNESS OF PATIENTS WITH COEXISTING HEART FAILURE AND DIABETES

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Coexistence of heart failure (HF) and type 2-diabetes is associated with high cardiovascular mortality. Intensive medical treatment of HF patients with diabetes may reduce the endothelial dysfunction and the accelerated atherosclerotic process seen in these patients.

To study this, we investigated the endothelial function and the presence of atherosclerosis measured by flow-mediated vasodilatation (FMD) and intima-media thickness (IMT) in intensively treated patients with coexisting HF and diabetes.

**Methods:** FMD of the brachial artery and IMT of the common carotid arteries were determined in 26 patients with HF and diabetes who were in intensive medical therapy as well as in 19 healthy controls. The two groups were matched according to age and sex. In all subjects left ventricular ejection fraction was measured by two-dimensional echocardiography (LVEF). Biochemical parameters including serum cholesterol, high and low density lipoprotein-cholesterol, triglyceride, glucose, hemoglobin/hemoglobin-A<sub>1c</sub> (HbA<sub>1c</sub>), brain natriuretic peptide (BNP) and N-terminal pro-BNP were also assessed.

**Results:** Mean FMD and IMT did not differ significantly between patients and controls. LVEF was lower in patients compared to controls ( $P < 0.001$ ). The group of patients had a higher mean BNP, NT pro-BNP, triglyceride, HbA<sub>1c</sub> and glucose in comparison to controls. Cholesterol, HDL-cholesterol and LDL-cholesterol were lower in patients compared to controls.

**Conclusion:** Intensively treated patients with coexisting HF and diabetes seem to have normal endothelial function as measured by FMD and they have no sign of accelerated atherosclerosis as measured by IMT. This suggests a positive effect of medication on the cardiovascular alterations in this group of patients.

#### P.089

##### CAROTID INTIMA-MEDIA THICKNESS IN NON-SMOKING HIV PATIENTS TREATED WITH ANTIRETROVIRAL THERAPY: FOCUS ON LIPID PROFILE

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**Introduction:** Increased cardio-vascular risk in HIV patients in antiretroviral therapy (ART) may be due to HIV infection, direct effect of ART or dyslipidemia induced by ART. Our aim was to study the relative importance of HIV, ART and dyslipidemia on atherosclerosis as measured by carotid artery intima-media thickness (IMT). To do so, we compared IMT in non-smoking HIV patients with high or low serum cholesterol levels as well as in healthy volunteers.

**Methods:** HIV patients in ART with normal ( $\leq 5.5$  mmol/L;  $n = 13$ ) or high cholesterol ( $\geq 6.5$  mmol/L;  $n = 12$ ) as well as healthy controls ( $n = 14$ ) were included. All were non-smokers and had never received medication for dyslipidemia or hypertension. IMT was measured by ultrasonography.

**Results:** IMT in HIV patients with hypercholesterolemia ( $\leq 5.5$  mmol/L), HIV patients with normal cholesterol ( $\geq 6.5$  mmol/L) and controls was  $683 \pm 119$ ,  $656 \pm 99$  and  $657 \pm 99$   $\mu\text{m}$ , respectively. IMT was similar in patients receiving and not receiving protease inhibitors ( $658 \pm 117$  vs.  $687 \pm 97$   $\mu\text{m}$ ). IMT in HIV patients correlated inversely with HDL-cholesterol levels ( $r = -0.50$ ;  $p = 0.01$ ), whereas no correlation was found with total cholesterol or LDL-cholesterol.

**Conclusions:** In non-smoking HIV patients receiving ART no sign of accelerated atherosclerosis as assessed by IMT were found even if patients were hypercholesterolemic. IMT correlated with HDL- but not LDL-cholesterol further indicating that reduction in cardio-vascular risk in these patients probably mainly should be aimed at reducing traditional risk factors rather than lipid lowering with statins.

#### P.090

##### ARTERIAL STIFFNESS AND ITS RELATION TO ENDOTHELIAL AND MICROCIRCULATORY FUNCTIONS IN HEALTHY MALES

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Arterial stiffness is suggested to be a replacement method to measurements of brachial diameter following the release of an ischemic stimulus. We tested this hypothesis by comparing resting large [C1] and small [C2] arterial stiffness (as well as total peripheral resistance [TPR]) with brachial flow mediated dilation (FMD, indicator of endothelial function). Furthermore, the anatomical location that C2 represents is unclear. Could this reflect microcirculatory changes? We tested this hypothesis by comparing C2 with concurrent microcirculatory responses.

29 subjects (aged 18 to 30 years) were investigated. A tonometer recorded the radial blood pressure; pulse waveform analysis (PWA) was used to calculate C1, C2 and TPR. These parameters were correlated with forearm FMD responses. FMD was taken as the % maximal change in brachial arterial lumen diameter following cuff release and measured by B-mode ultrasound. Microcirculatory parameters included finger flux measured by Laser Doppler Fluxmetry [LDF]; pulsatile finger volume measured by photoplethysmography [PPG] and palm skin temperature measured by infrared thermography [Tpalm].

FMD linearly related to C1 ( $r = 0.4$ ,  $P = 0.04$ ), but not C2 ( $P > 0.05$ ). Comparison of arterial stiffness against microcirculatory responses revealed a weak relation between C2 and %PPG ( $r = 0.38$ ,  $P = 0.07$ ), but no relations were found for C1 ( $P > 0.05$ ). For TPR, a linear relation was found with %PPG ( $r = 0.50$ ,  $P = 0.01$ ) and %Tpalm ( $r = 0.59$ ,  $P < 0.001$ ). No other correlations were evident ( $P > 0.05$ ).

Small arterial stiffness (C2) is neither a viable marker for endothelial function nor of microcirculatory responses. The findings show that sonographically assessed brachial FMD is the better method for endothelial function testing.