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### **P.056: CAFFEINE CONSUMPTION ACUTELY INDUCES “CHAOS” IN BLOOD PRESSURE VARIABILITY, AS ASSESSED BY APPLANATION TONOMETRY OF THE RADIAL ARTERY AND DETRENDED FLUCTUATION ANALYSIS.**

T.G. Papaioannou\*, C. Vlachopoulos, N. Ioakeimidis, N. Alexopoulos, C. Stefanadis

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in the levels of cholesterol, triglycerides, glucose. Betaxolol has been well tolerated in most patients.

**Conclusion:** These results demonstrate that betaxolol increases arterial distensibility. This effect of betaxolol should be attributed to BP lowering and endothelial function improvement.

#### P.053

##### PROGNOSTIC SIGNIFICANCE OF FLOW MEDIATED DILATATION OF THE BRACHIAL ARTERY IN HYPERTENSIVE PATIENTS.

M. Salvetti\*, M.L. Muesan, A. Pains, E. Belotti, G. Galbassini, V. Paderno, C. Agabiti-Rosei, C. Aggiusti, E. Agabiti-Rosei. *Internal Medicine, Brescia, Italy*

**Background:** In uncomplicated hypertensive patients the prognostic role of endothelial dysfunction, as evaluated by flow-mediated vasodilatation of the brachial artery, has not been investigated.

**Methods:** A total of 175 prospectively identified uncomplicated hypertensives (age  $53 \pm 5$  years, 42% women, 48 with diabetes mellitus type 2) were studied. At baseline all subjects were untreated and underwent a baseline standard laboratory examinations. A standard echocardiogram was performed for the evaluation of LV anatomy and function and patients with systolic dysfunction or LV wall motion abnormalities were excluded. Endothelial function was measured as flow-mediated dilation of the brachial artery using high-resolution ultrasound.

**Results:** Patients were followed for  $86 \pm 34$  months (range 11-123 months). A first non fatal or fatal cardiovascular event occurred in 28 patients. The incidence of cardiovascular events was 1.4 and 3.1 per 100 patient-years in patients with a FMD above ( $n = 87$ ) and below ( $n = 88$ ) the median value, respectively ( $p < 0.005$  by the log-rank test). In Cox analysis, controlling for age, gender, diabetes, hypercholesterolemia, smoking, and systolic BP at baseline, a low FMD conferred an increased risk of cardiovascular events (odds ratio 2.27, 95% confidence interval [CI] 1.01-5.15,  $p < 0.001$ ).

**Conclusions:** The presence of endothelial dysfunction, as evaluated by flow-mediated vasodilatation of the brachial artery, identifies hypertensive patients at increased risk of non fatal and fatal cardiovascular events.

#### P.054

##### LOCAL ARTERIAL WAVE SPEED AT CAROTID ARTERY LEVEL IS REPRESENTATIVE OF CAROTIDO-FEMORAL PULSE WAVE VELOCITY AND AORTIC STIFFNESS: EVIDENCE BY A NEW ECHO-TRACKING APPROACH

E. Malshi<sup>1</sup>\*, C. Morizzo<sup>1</sup>, M. Florescu<sup>2</sup>, M. Kozakova<sup>1</sup>, D. Vinereanu<sup>2</sup>, C. Palombo<sup>2</sup>. <sup>1</sup>University of Pisa, Department of Internal Medicine, Pisa, Italy, <sup>2</sup>University Hospital, Department of Cardiology, Bucharest, Romania

Carotido-femoral (CF) pulse wave velocity (PWV) is a marker of aortic stiffness. Recently a new ultrasound technique capable to provide real-time arterial waveform analysis ("E-track", Aloka) has been developed. When calibrated for blood pressure (BP), arterial stiffness parameters and a single point local wave speed (WS) are obtained.

Aim of this study was to evaluate whether or not common carotid (CCA) local WS may be representative of CF-PWV.

Thirty-one patients free of cardiovascular disease, with or without atherosclerotic risk factors (16 males; mean age  $55 \pm 12$ , age range 24-72; mean BP  $137 \pm 17/81 \pm 21$  mmHg), underwent right CCA scanning by high resolution linear US probe (7.5 to 10 MHz, Aloka SSD-5500) for E-track evaluation. Single-point WS at CCA level was computed as  $WS = (\Delta P/2\beta)$ . CF-PWV and carotido-radial PWV (CR-PWV) were assessed by Complior (Artech, Paris). For both methods, at least 5 consecutive beats were averaged.

Mean WS, CF-PWV and CR-PWV were  $9 \pm 4$  m/s,  $10.1 \pm 2$  m/s,  $10.9 \pm 1$  m/s ( $p = n.s.$ ). WS was directly related to CF-PWV ( $r = 0.60$ ,  $p < 0.001$ ) but not to CR-PWV ( $r = 0.22$ ,  $p = n.s.$ ). At Bland-Altman analysis, mean difference between WS and CF-PWV was  $-1.15 \pm 3.58$ , with all measurements but one within  $\pm 2sd$ . Both "Beta" and "Epsilon" derived by E-track also correlated directly with CF-PWV ( $r = 0.50$  and  $0.55$ , respectively,  $p < 0.005$ ) but not with CR-PWV. Finally, the known correlations with age and pulse pressure were confirmed for both CF-PWV and WS ( $r$  between 0.40 and 0.65).

CCA stiffness and local WS appear representative of aortic stiffness as estimated by CF-PWV.

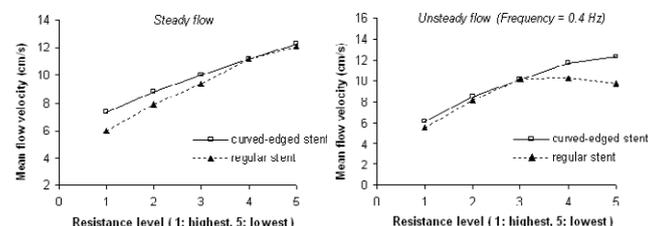
#### P.055

##### EXPERIMENTAL STUDY OF THE EFFECTS OF A NEW NON-CYLINDRIC "CURVED-EDGED" STENT ON FLOW CHARACTERISTICS IN A MODEL OF A MILD ARTERIAL STENOSIS

T.G. Papaioannou<sup>1</sup>\*, Ch.Ch. Christofidis<sup>1</sup>, D.S. Mathioulakis<sup>1</sup>, C.I. Stefanadis<sup>2</sup>. <sup>1</sup>Fluids Section, School of Mechanical Engineering, National Technical University of Athens, Athens, Greece, <sup>2</sup>Unit of Biomedical Engineering, First Dept. of Cardiology, Hippocraton Hospital, Medical School, National & Kapodistrian University of Athens, Athens, Greece

**Background and Methods:** Restenosis remains a major concern in vascular stenting, especially for ostial lesions. The purpose of this study was to investigate whether a non-cylindric stent, (with curved edges), implanted upstream of a mild arterial stenosis could be beneficial by increasing blood flow velocity and by limiting the flow recirculation zone in the vicinity of the stenosis. Steady and pulsatile flow fields were investigated in an axisymmetric model of an ostially stented arterial segment followed by a 50% stenosis, in an in-vitro model employing flow visualization technique. The stenosis was located close to the tube entrance a certain distance apart. Two different tube-entrance geometries, modelling a stented arterial segment, were studied regarding their effect on flow patterns at various Reynolds numbers ( $Re = 300-800$ ).

**Results:** A decrease 3-6% in flow recirculation region at the vicinity distally to a 50% stenosis was observed when the "curved-edged" stent was used in the models compared to the regular cylindrical stent. Mean flow velocity was increased for both steady flow (especially at low resistance) and pulsatile flow (for higher resistance), when the curved-edged configuration was used instead of the regular stent (figure).



**Conclusions:** These effects induced by the new stent configuration could be important and may potentially contribute to the delay of restenosis processes, which remains to be clarified in-vivo.

#### P.056

##### CAFFEINE CONSUMPTION ACUTELY INDUCES "CHAOS" IN BLOOD PRESSURE VARIABILITY, AS ASSESSED BY APPLANATION TONOMOMETRY OF THE RADIAL ARTERY AND DETRENDED FLUCTUATION ANALYSIS.

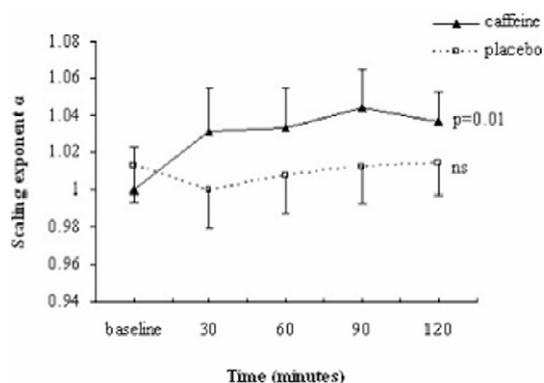
T.G. Papaioannou\*, C. Vlachopoulos, N. Ioakeimidis, N. Alexopoulos, C. Stefanadis. *First Dept. of Cardiology, Hippocraton Hospital, Medical School, National & Kapodistrian University of Athens, Athens, Greece*

The occurrence of continuous blood pressure (BP) fluctuations is an intrinsic feature of the cardiovascular system and is related to complex cardiovascular mechanisms and environmental stimulations or daily habits (i.e. coffee drinking). The aim of this study was to investigate the effect of caffeine on indices expressing the "chaotic", nonlinear characteristics of BP variability.

**Methods:** Fourteen healthy subjects consumed 240 mg of caffeine or placebo according to a randomized, double-blind, crossover design. Radial pressure waveforms were recorded by applanation tonometry of the radial artery at baseline and 30, 60, 90 and 120 min after ingestion of caffeine or placebo. Detrended fluctuation analysis was used to quantify the fractal correlation properties of the BP data by estimating the scaling (self-similarity) exponent  $\alpha$ . Approximate entropy (ApEn) was also determined to assess BP irregularity. Analysis of variance for repeated measurements was used to assess changes in the measured variables over time.

**Results:** BP fluctuations demonstrated high regularity and predictability as indicated by the low values of ApEn ( $-0.2 \pm 0.3$ ), and they remained unchanged after caffeine ingestion. In contrast, the long-term scaling exponent  $\alpha$  of the BP time series was significantly increased from 0.99 to 1.04 ( $p = 0.01$ ) after caffeine ingestion, while the placebo induced no significant change (figure).

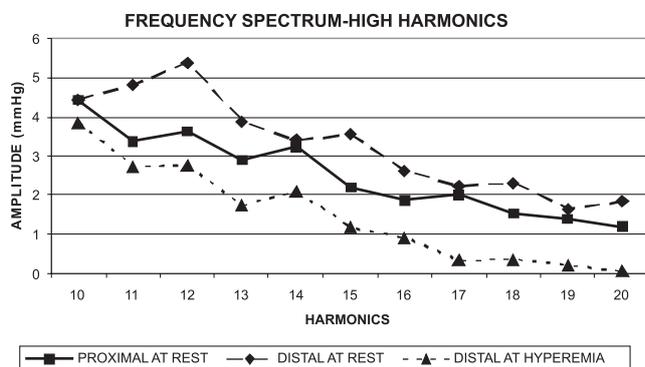
**Conclusions:** Caffeine induced greater "randomness" in BP fluctuations. This caffeine effect might be considered to be beneficial but it should be further investigated.



**P.057**  
EFFECTS OF CORONARY MICROCIRCULATION ON INTRACORONARY PRESSURE WAVEFORMS AS ASSESSED BY FAST FOURIER TRANSFORM ANALYSIS

E. Stamatopoulos\*, M. Vavuranakis, T.G. Papaioannou, S. Nikolopoulos, C. Stefanadis. *1st Dept. of Cardiology, Unit of Biomedical Engineering, Hippokraton Hospital, Medical School, National & Kapodistrian University of Athens, Athens, Greece*

Wave reflections from the periphery of the systematic circulation are known to be important determinants of the morphology of aortic pressure waveforms. Similar data regarding the effects of coronary microcirculation on intracoronary pressure waveforms are limited. We sought to investigate whether drug-induced changes of coronary microcirculation are reflected in the modification of intracoronary pressure waveforms. In eighteen patients with normal myocardial contractile function we studied pressure waveforms recorded by a high-fidelity pressure wire at the ostium and at a distal site of left anterior descending coronary artery, which had to be free of significant lesions in the epicardial and the microvascular segment, i.e. fractional flow reserve >0.75, corrected TIMI frame count <27 and coronary flow reserve by thermodilution >2.5. Pressure recording was performed both at rest and at hyperemia induced by intravenous infusion of adenosine. Analysis of pressure waveforms at the frequency domain was performed with Fast Fourier Transform. At baseline conditions, distal vs proximal pressure waveforms were characterized by higher pulsatility: higher fractional pulse pressure  $\Delta$ PPf ( $p=0.009$ ), a higher presystolic wave probably due to atrial contraction ( $p<0.001$ ) and higher amplitude of the eleventh to the fifteenth harmonics ( $p=0.001$ ). Hyperemia increased  $\Delta$ PPf ( $p=0.01$ ), compressed the notch and decreased the amplitude of higher than the tenth harmonics of distal waveforms ( $p<0.001$ ) (Figure).



The configuration of intracoronary pressure waveforms is significantly affected by the status of coronary microcirculation. Therefore, their analysis may facilitate assessment of microvascular disease.

**P.058**  
LEFT VENTRICULAR FUNCTION IN RELATION TO ARTERIAL STIFFNESS IN HYPERTENSION. THE PROGNOSTIC IMPORTANCE OF PULSE PRESSURE IN LV REMODELLING - PRELIMINARY REPORT

H. Pavlopoulos\*, E. Phillipou, J. Grapsa, P. Nihoyannopoulos. *Hammersmith Hospital, London, United Kingdom*

**Background.** Increased arterial stiffness has been reported to affect LV diastolic function in hypertension. Pulse pressure (PP) is independently

related to cardiovascular and all-cause mortality. Strain and strain rate deformation parameters can detect subtle changes of the left ventricular (LV) function.

**Aim.** To investigate the role of arterial stiffness in Systolic LV function and the effect of Pulse pressure in hypertension.

**Methods.** We studied 55 consecutive hypertensive patients and 25 controls, matched for age ( $49.7\pm 5.7$  vs.  $45.5\pm 4.1$  yrs), with normal EF ( $66\pm 2.5$  vs.  $64\pm 3.3\%$ , NS). All subjects had 2D and colour doppler myocardial imaging of basal and mid LV segments (12) in the longitudinal axis. Mean longitudinal strain (S) and strain rate (SR) were averaged from each of the 12 segments assessed. Pulse wave velocity (PWV) carotid-femoral was used for estimation of arterial compliance in 20 of the hypertensive patients.

**Results.** The hypertensive group had higher pulse pressure ( $59.5\pm 16.6$  vs.  $41.4\pm 7.2$  mmHg,  $P<0.001$ ), and lower mean longitudinal S and SR (S:  $18.1\pm 2.2$  vs.  $20.5\pm 2.0\%$   $P<0.05$  and SR:  $1.34\pm 0.16$  vs.  $1.54\pm 0.13/s$   $P<0.05$ ) compared to control. The patients with hypertrophy or diastolic dysfunction (DD) had higher PP than those without hypertrophy ( $65\pm 15$  vs.  $46\pm 11$  mmHg,  $P<0.001$ ) or DD ( $63\pm 16$  vs.  $44\pm 12$  mmHg,  $P<0.001$ ). Pulse pressure was correlated with LVMI ( $r=0.51$ ,  $P<0.001$ ), WT ( $r=0.61$ ,  $P<0.001$ ), RWT ( $r=0.52$ ,  $P<0.001$ ), mean SR ( $f=-0.58$ ,  $P<0.001$ ), mean S ( $f=-0.51$ ,  $P<0.001$ ), DT ( $r=0.36$ ,  $P<0.05$ ), A ( $r=0.45$ ,  $P<0.05$ ) and E/A ( $f=-0.54$ ,  $P<0.01$ ). PWV was correlated with mean S and SR ( $f=-0.58$ ,  $P<0.05$  and  $f=-0.49$ ,  $P<0.05$ ) and PP ( $r=0.47$ ,  $P<0.05$ ).

**Conclusion.** Pulse pressure is related with functional (S, SR) and structural (WT, LVMI, RWT) components of the left ventricle and with the arterial stiffness. Arterial stiffness seems to affect not only the diastolic, but also the longitudinal systolic function of the left ventricle.

**P.059**  
SEGMENTAL LEFT VENTRICULAR FUNCTION ESTIMATED BY STRAIN ECHOCARDIOGRAPHY IN RELATION TO ARTERIAL STIFFNESS IN HYPERTENSIVES. MRI FINDINGS IN RESPECT TO MYOCARDIAL FIBROSIS - PRELIMINARY REPORT

H. Pavlopoulos\*, J. Grapsa, E. Phillipou, P. Nihoyannopoulos. *Hammersmith Hospital, London, United Kingdom*

**Background:** Left Ventricular (LV) diastolic function has been reported to be related with the presence of increased arterial stiffness in hypertension. Myocardial fibrosis is one of the main causes of diastolic dysfunction (DD).

**Aim:** To investigate the role of arterial stiffness in segmental LV systolic function and the presence of fibrosis with Delayed Enhancement (DE) MRI in hypertension.

**Methods:** We studied 20 consecutive hypertensive patients with mean age  $51.6\pm 6.1$  years and normal EF  $66.3\pm 4.1\%$ , with no history of coronary artery disease. All subjects had MRI with (DE) and 2D and colour doppler myocardial imaging of basal and mid LV segments (12) in the longitudinal axis. Mean longitudinal strain (S) and strain rate (SR) were averaged from each of the 12 segments assessed. Pulse wave velocity (PWV) carotid-femoral was measured.

Diastolic dysfunction was diagnosed based on published criteria regarding DT, IVRT, E/A and TDIEa.

**Results:** The mean duration of hypertension was  $10.4\pm 5.7$  yrs. Diastolic dysfunction was evident in 16 out of the 20 patients. PWV was increased in patients with diastolic dysfunction ( $12.6\pm 2.3$  vs.  $10.6\pm 1.4$  m/s) compared to those without DD. Septal basal and mid segment had the lowest systolic strain (basal:  $15\pm 2.7\%$ , mid:  $19.5\pm 3.1\%$ ) and strain rate value (basal:  $1.1\pm 0.2/s$ , mid:  $1.4\pm 0.3/s$ ) in comparison to the other segments. PWV was correlated with septal mid SR ( $r=-0.60$ ,  $P<0.05$ ) and septal basal and mid S ( $r=-0.67$ ,  $P<0.05$  and  $r=-0.69$ ,  $P<0.05$ ). PWV was also correlated with mean S and SR ( $r=-0.58$ ,  $P<0.05$  and  $r=-0.49$ ,  $P<0.05$ ) and PP ( $r=0.47$ ,  $P<0.05$ ). MRI with DE detected 2 patients (10%) having replacement fibrosis, but did not detect interstitial or perivascular fibrosis.

**Conclusion:** Septal wall is the region mainly affected by the presence of hypertension in comparison to other segments. Arterial stiffness is related to global and regional longitudinal systolic function. MRI can exclude replacement but not subtle interstitial or perivascular fibrosis in hypertensive patients.

**P.060**  
AGE-RELATED ARTERIAL STIFFNESS IN PATIENTS WITH WHITE COAT OR ESSENTIAL HYPERTENSION

G. Vyssoulis\*, S.M. Kyvelou, P. Pietri, D. Adamopoulos, C. Vlachopoulos, A. Deligeorgis, E. Gymnopoulos, C. Stefanadis. *Hypertension Unit, 1st Department of Cardiology, Athens Medical School, Hippokraton Hospital, Athens, Greece*

**Background:** It is well documented that arterial stiffness is age-related. The purpose of the present study was to evaluate to what extent age affects