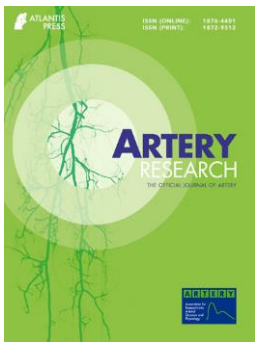

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P.052: BLOOD PRESSURE AND LARGE ARTERIAL ELASTIC PROPERTIES. BENEFIT OF BETAXOLOL IN HYPERTENSION

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waveform. We investigated this during cardiac catheterisation, examining the effects of pacing and nitroglycerin (NTG) on estimation of central systolic pressure from the peripheral pulse.
Methods: Patients undergoing coronary angioplasty (n = 11, aged 48 to 72 years) participated. A Millar SPC-454D or fluid filled catheter was placed in the aortic root and a pacing wire in the right atrium. Peripheral digital arterial waveforms (Finometer) and aortic waveforms were obtained at baseline, during pacing at 20 bpm above resting heart rate and during administration of NTG (10 and 100 μg/min, i.v.).
Results: Pacing and NTG produced marked changes in central and peripheral waveforms, reducing central augmentation index from 40.4±6.2 to 22.6±8.9% and from 40.4±6.2 to 12.7±7.0% for pacing and NTG 100 μg/min respectively (each P < 0.01). At baseline and during all interventions, there was a close correlation between central systolic blood pressure and absolute finger systolic pressure at the point of late systolic augmentation (R = 0.95, P < 0.0001). The mean difference between measured central aortic systolic BP and that estimated from digital pressure was 2.2 mmHg SD 6.2 mmHg.
Conclusions: These data suggest that central systolic blood pressure can be estimated directly from non-invasive finger pressure waveforms even during interventions such as pacing and NTG that produce a marked change in pressure waveforms.

P.049
EFFECTS OF INHIBITION OF NITRIC OXIDE SYNTHASE ON THE PERIPHERAL ARTERIAL WAVEFORM RESPONSE TO EXERCISE

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Introduction: Exercise reduces systolic augmentation in the peripheral pulse wave, an effect similar to that produced by the nitric oxide (NO) donor nitroglycerin (NTG). The changes produced by exercise persist into the recovery period for >30 min. The aim of this study was to investigate if the exercise induced changes are dependent on endothelium-derived NO. We used the NO synthase inhibitor N^G-monomethyl-L-arginine (L-NMMA) to test this.
Methods: Healthy volunteers (n = 10, 5 female, aged 19 to 33 years) participated in a 2-phase randomised controlled cross-over study. L-NMMA (6 mg/kg i.v. over 5 min) and saline placebo were given immediately before exercise on two occasions separated by at least 5 days. Mean arterial blood pressure (MAP by Finopress), radial augmentation index (RAIx by SphgymoCor) and cardiac output (Innocor) measurements were made at baseline, during infusion of L-NMMA/saline immediately before exercise, during exercise (except for radial artery measurements) and during recovery. Peripheral vascular resistance (PVR) was calculated from MAP and cardiac output. During exercise, workload increased from 25 W to 150 W by increments of 25 W at 2 min intervals.
Results: Before exercise, L-NMMA increased mean arterial blood pressure (85.1±3.8 vs. 101.2±4.3 mmHg, P < 0.01), peripheral vascular resistance (16.4±0.7 vs. 24.7±1.7 mmHg/ml/min, P < 0.01) and RAIx (50.2±4.5 vs. 70.2±6.5%, P < 0.01) and decreased heart rate (65.6±5.7 vs. 49.1±2.8 bpm, P < 0.01). During and after exercise, heart rate, MAP and PVR were similar after L-NMMA and saline. However, L-NMMA attenuated the exercise induced fall in RAIx so that RAIx was higher after L-NMMA compared to saline at 15 min in recovery (49.5±5.3 vs. 36.0±4.4%, P < 0.02).
Conclusion: These data suggest that, although endothelium derived NO has little effect in regulating PVR during/after exercise, it may have a role in mediating exercise induced changes in the pulse waveform.

P.050
THE INSULIN SENSITIZER ROSIGLITAZONE IMPROVES ENDOTHELIAL FUNCTION IN PATIENTS WITH TYPE 2 DIABETES ON INSULIN

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Aim: Thiazolidinediones (TZDs) are insulin sensitizers used to improve glycaemic control in diabetic patients. TZDs have also been reported to improve endothelial function in obese patients with insulin resistance and in diabetic patients on oral treatment. However, little is known about the vascular effects of TZDs in patients with type 2 diabetes treated with insulin. The aim of this study was to assess the effect of rosiglitazone on endothelial function in type 2 diabetic patients treated with insulin.
Methods: Thirty-one diabetic patients without known coronary artery, cerebrovascular or peripheral arterial disease, who were already on an insulin regime, were randomized into 2 groups; no treatment was added in group A (n = 14), while rosiglitazone (4 mg od) was added in group B (n = 17) for 6 months. Flow-mediated dilation (FMD) in the brachial artery was assessed in all patients, at baseline and at follow-up.
Results: At baseline, the 2 groups did not differ in age (mean±SD, 67.3±6.4 vs 64.7±7.6 years, respectively, p=ns), or any measured variable. In group A there were no significant changes at 6 months in any variable except for diastolic blood pressure that dropped from 79±7 to 72±12 mmHg (p < 0.05). In group B, a significant reduction in glycated hemoglobin (from 8.8±1.1 to 7.8±1.0%, p < 0.0005) and in fasting plasma glucose (from 186±64 to 144±61 mg/dl, p < 0.05) was observed at 6 months, while FMD significantly improved (from 1.43±1.46 to 2.98±1.80%, p < 0.005).
Conclusions: In insulin-treated type 2 diabetic patients, treatment with rosiglitazone for 6 months has a beneficial effect on glycaemic control and endothelial function.

P.051
EVALUATION OF ENDOTHELIAL FUNCTION WITH NON-INVASIVE METHODS IN DIFFERENT CARDIOVASCULAR DISEASES

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The aim of our study was to evaluate microvascular reactivity and arterial stiffness with non-invasive methods in patients with different cardiovascular risk factors. Following blood pressure measurement, skin microcirculation was studied with laser Doppler flowmetry (Periflux 5001). The effect of local heating (LH; 44ºC, 1 min) and the postocclusive reactive hyperaemia (PORH; 220 mmHg, 3 min) were measured. Arterial stiffness was evaluated with the newly developed TensioClinic Arteriograf instrument which calculate the pulse wave velocity (PWV, m/s) and augmentation index (Aix, %). Healthy controls (CONT, n = 13), patients with essential hypertension (EH, n = 13), with essential hypertension and peripheral artery disease (EH+PAD, n = 22), and essential hypertension and 2-type diabetes mellitus (EH+DM, n = 25) were measured. Pulse pressure (PP) was higher in EH+PAD (62.6±3.2 mmHg, p < 0.05) and EH+DM (67.6±3.3 mmHg, p < 0.001) groups compared with CONT (52.5±3.4 mmHg). Aix, PWV and the PORH were significantly different in healthy controls (–62.11%, 7.01 m/s, 393.77%, resp.) compared to the patient groups. These parameters were significantly different in the EH (–34.25%, 7.91 m/s, 292.77%), EH+PAD (0.34%, 9.16 m/s, 182.86%) and EH+DM groups (0.87%, 9.27 m/s, 192.84%). The reactive hyperaemia for LH was significantly lower in the EH (782±106%), EH+PAD (651±53%) and EH+DM (453±45%) compared with the CONT (1049±133%). Significant correlation was found between the PORH and Aix (r = –0.54; p < 0.001) and PP and Aix (r = 0.42, p < 0.05). Using these non-invasive methods there is a growing possibility to diagnose endothelial dysfunction in patients with different cardiovascular diseases. Prospective studies are needed to evaluate the prognostic value and the utility in therapy follow-up of these methods.

P.052
BLOOD PRESSURE AND LARGE ARTERIAL ELASTIC PROPERTIES. BENEFIT OF BETAXOLOL IN HYPERTENSION

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Background and Aim: Large artery damage is a major contributory factor to cardiovascular morbidity and mortality of patients with hypertension. As shown ASCOT and other study, beta-blockers appear to be less effective than other drugs in improving outcome in hypertensive patients, and a potential explanation may be that beta-blockers are less effective in reducing arterial stiffness. However, the aim of this study was to prove otherwise while assessing the direct effect of cardioselective beta-adrenoblocker betaxolol (Lokren) on arterial distensibility in patients with mild, moderate and severe hypertension.
Materials and Methods: 50 hypertensive patients (mean age 54.7±14.3 years, 28 male, 32 female) received betaxolol in individual titrated doses 10–40 mg (mean dose 14.7±6.8 mg) daily for 3 months. The examination comprised routine tests, ECG, blood glucose, total cholesterol, triglycerides. The assessment of arterial stiffness was done by way of measuring brachial-ankle pulse wave velocity (baPWV). Systemic arterial compliance was estimated through brachial Augmentation Index (AI_b), Endothelial function was calculated based on flow-mediated dilatation (FMD) parameters.
Results: The treatment produced a significant reduction in systolic (–27.2 mmHg) and diastolic BP (–12.3 mmHg). No fluctuation of AI_b was monitored which should be attributed to the pulse decrease from 74.3 to 60.6 beats/min (p < 0.001). Significant decrease of baPWV (by 8.1%) and increase of FMD (by 10.9%) was observed. There was an insignificant rise

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.

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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±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±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

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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±12, age range 24–72; mean BP 137±17/81±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 = (ΔP/2Beta). 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±4 m/s, 10.1±2 m/s, 10.9±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±3.58, with all measurements but one within ±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

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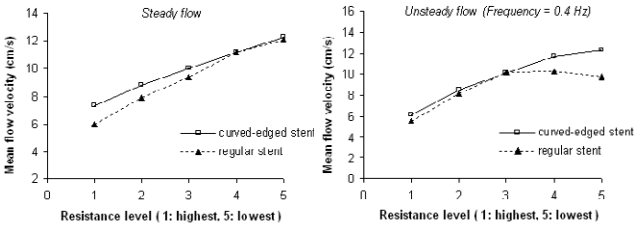
Background and Methods: Restenosis remains a major concern in vascular stenting, especially for ostial lesions. The purpose of this study was to investigate whether a non-cylindric stent, (with curved edges), implanted upstream of a mild arterial stenosis could be beneficial by increasing blood flow 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 cylindric 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 TONOMETRY OF THE RADIAL ARTERY AND DETRENDED FLUCTUATION ANALYSIS.

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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 α. 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±0.3), and they remained unchanged after caffeine ingestion. In contrast, the long-term scaling exponent α 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.