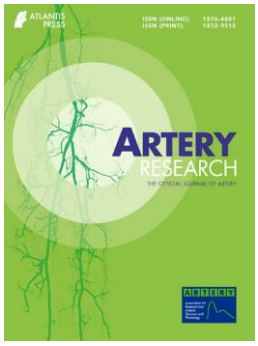

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P.082: BENEFICIAL EFFECT OF LAUGHTER ON ARTERIAL STIFFNESS AND WAVE REFLECTIONS: THE ROLE OF INFLAMMATION, ENDOTHELIAL FUNCTION AND OXIDATIVE STATUS

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Ultrasound scans of the distal common carotid artery (right/left) were obtained from 120 patients with cardiovascular risk factors and 30 healthy controls. The C-IMT was measured on the far wall, 1 cm above the bifurcation. The dataset was analysed by two operators both automatically and manually. The first operator repeated the analysis twice.

The agreement between automatic and manual measurements was evaluated by Bland-Altman plots: a bias of -0.020mm and an interval of agreement of 0.027mm were obtained. Intra-observer variability was computed on the repeated measurements of the first operator. Bias was not significantly different from zero for both manual and automatic measurements, whereas the interval of agreement was 0.077mm in manual analysis and 0.012mm in automatic analysis. Coefficients of variation of 2.8% and 0.4% were obtained, respectively. Inter-observer variability showed a little bias (-0.032mm) only for manual analysis, whereas the interval of agreement was 0.075mm in manual analysis and 0.021mm in automatic analysis with coefficients of variation of 4.5% and 0.6%, respectively.

In conclusion, the new real-time automatic system represents a more feasible and reproducible method than the manual approach when used to estimate C-IMT in clinical studies and practice.

P.079
EFFECTS OF LOW-GRADE INFLAMMATION ON ARTERIAL STIFFNESS AND WAVE REFLECTIONS IN HYPERTENSIVE PATIENTS WITH METABOLIC SYNDROME

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Purpose: Metabolic syndrome is related to increased inflammatory status. Arterial stiffness is an important determinant of cardiovascular performance and a predictor of the corresponding risk. The aim of the present study was to investigate the association of low-grade inflammation with arterial stiffness and wave reflections in hypertensive patients with metabolic syndrome.
Methods: We studied 106 consecutive patients with never treated essential hypertension and metabolic syndrome, defined according to the Adult Treatment Panel III criteria. Arterial stiffness was assessed by measuring carotid-femoral (PWVc-f) and carotid-radial pulse wave velocity (PWVc-r). Heart rate corrected augmentation index (AIx_{75}) was studied as a measure of wave reflections and arterial stiffness. High-sensitivity C-reactive protein (hsCRP), serum amyloid A (SAA) and fibrinogen were measured as inflammatory indices using immunonephelometry.
Results: In univariate analysis, PWVc-f was correlated with both loghsCRP ($r=0.28$, $p=0.003$) and fibrinogen ($r=0.29$, $p=0.003$) whereas PWVc-r was associated with loghsCRP ($r=0.21$, $p=0.03$) and logSAA ($r=0.22$, $p=0.05$). No correlation was found between AIx_{75} and any of the measured biomarkers. After adjustment for several confounders, an independent association was observed between PWVc-f and loghsCRP ($\beta=0.24$, $p=0.01$) and fibrinogen ($\beta=0.16$, $p=0.04$) whereas an independent correlation was also emerged between PWVc-r and loghsCRP ($\beta=0.22$, $p=0.02$).
Conclusion: In hypertensive patients with metabolic syndrome both hsCRP and fibrinogen are related to arterial stiffness but not to wave reflections. This finding elucidates the potential role of inflammation in arterial stiffening in patients with hypertension and metabolic syndrome and may have important clinical implications.

P.080
AGE-RELATED CAROTID REMODELING AND WALL SHEAR RATE: INSIGHTS FROM A NOVEL MULTIGATE DOPPLER SYSTEM FOR INTEGRATED EVALUATION OF FLOW VELOCITY PROFILE AND DIAMETERS

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Background: Wall Shear Rate (WSR) is a main determinant of shear stress (WSS), the viscous drag exerted on the arterial wall by the flowing blood. In human studies WSR is only roughly estimated by a static measurement of diameter and centerline systolic flow velocity. A double beam multigate Doppler (MGD) system, capable to provide simultaneous monitoring of arterial diameter and WSR, was recently developed and validated by our group.
Aim: To investigate in man the relations between WSR, age, arterial geometry and distension in common carotid artery (CCA) by MGD.
Methods: Twentyfive normotensive subjects, age 30-53, underwent CCA scan by an ultrasound system (Esaote Megas, 7.5-10.0 MHz probe) interfaced with MGD. Ultrasound beams were setted transversely for diameter assessment, and at an interbeam angle of 35° for flow velocity profile and WSR determination. Autocorrelation algorithm and spectral analysis of backscattered signals from walls an erithrocytes were used for estimating distension and WSR, respectively. IMT was also measured.
Results: Mean CCA diameter and distension were 6.9 ± 0.6 mm and 499 ± 188 μm; WSR (average through cardiac cycle) was 335 ± 87 s^{-1} and 283 ± 80 s^{-1} at near and far wall. WSR was inversely related (r from -0.47 and −0.52) to age, diastolic BP, CCA diameter and IMT, and directly to distension ($r = 0.41$). Significant relations with age were confirmed for BP, carotid diameter and IMT.
Conclusion: Our findings are in keeping with the hypothesis that an age-related reduction of WSR, possibly associated to vessel dilation, may represent a mechanism underlying the age-related IMT increase.

P.081
VALIDITY OF THE ONE-THIRD RULE TO CALCULATE MEAN ARTERIAL PRESSURE

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Objective: Empirical formulas are frequently used to estimate mean arterial pressure (MAP) from systolic (SBP) and diastolic (DBP) blood pressure. We investigated the validity of the $1/3^{rd}$-$2/3^{rd}$ rule (one-third of the pulse pressure (PP) to the DBP) for the radial, brachial and carotid artery using tonometry.
Methods and results: Radial, brachial and carotid tonometer measurements were performed in 1927 subjects (1423 normotensives and 504 hypertensives, age 35-55, 1008 men and 919 women). First, brachial tonometry curves were calibrated using sphygmomanometer systolic and diastolic blood pressure, and MAP_{bra} was assessed as the numerical average of this curve. Second, radial and carotid waveforms were calibrated using DBP_{bra} and MAP_{bra}, assuming these values are constant through the arterial tree. We calculated the percentage (form factor) of the PP to be added to the DBP to assess MAP at the radial (FF_{rad}), brachial (FF_{bra}) and carotid artery (FF_{car})(Table 1).

Table 1

	Men	Women	Total
MAP, mmHg (SD)	101.1 (11.7)	98.6 (12.3)	99.9 (12.1)
FF_{rad}, % (SD)	36.8 (3.1)	39.5 (2.9)	38.1 (3.3)
FF_{bra}, % (SD)	41.3 (3.0)	43.7 (3.1)	42.4 (3.3)
FF_{car}, % (SD)	43.8 (3.2)	44.1 (3.4)	43.9 (3.3)

Conclusions: (1) Using the one-third rule underestimates the MAP. (2) FF^{bra}, 42.4% is in agreement with the earlier reported form factor of 40%, validated with intrabrachial pressure (W. Bos et al.). (3) The form factor seems to depend strongly on the artery measured. It decreases from the aorta to the peripheral arteries and differs between men and women, with a higher associated factor for women.

P.082
BENEFICIAL EFFECT OF LAUGHTER ON ARTERIAL STIFFNESS AND WAVE REFLECTIONS: THE ROLE OF INFLAMMATION, ENDOTHELIAL FUNCTION AND OXIDATIVE STATUS

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Background: Unfavourable psychogenic factors increase the risk of cardiovascular outcomes. Aim of this study was to evaluate the impact of a positive psychological intervention (laughter) on aortic stiffness and wave reflections, known determinants of cardiovascular performance and predictors of

the corresponding risk. Moreover, we sought to explore possible underlying mechanisms, notably inflammation, platelet activation, endothelial function and oxidative stress.
Methods: 18 healthy volunteers (age 28 ± 5 years) watched a 30 minutes long segment of a comic film. Measurements were made before, 0, 15 and 30 minutes after the movie. Carotid-femoral pulse wave velocity (cfPWV) was measured as an index of aortic stiffness. Wave reflections were studied using arterial tonometry; augmentation index (AIx) was measured as index of wave reflections. Blood samples were drawn before and 15 minutes after the movie. P selectin levels, soluble vascular cell adhesion molecule 1 (s VCAM-1), total antioxidant status (TAS) were measured by enzyme-linked immunosorbent assay.
Results: Laughter induced by the comedy led to a significant decrease in cfPWV by 0.30 m/sec and AIx by 3.83% (both at 15 minutes, $p< 0.05$). P selectin levels decreased by 18 ng/mL, sVCAM-1 decreased by 47.56 ng/mL, (all $p<0.05$). TAS did not change significantly, $p=0.47$.
Conclusions: This study shows that laughter has a beneficial effect on arterial elastic properties and wave reflections. Attenuation of endothelial injury, platelet activation and inflammatory response, as indicated by decreased levels of P selectin and sVCAM-1, is a possible underlying pathway, while oxidative status is not altered.

P.083
COMPARISON OF LOCAL CAROTID AND AORTIC STIFFNESS PARAMETERS IN MILD ESSENTIAL HYPERTENSIVE PATIENTS

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Arterial stiffness (AS) can be evaluated by local pulse pressure (PP) and arterial diameter changes. We aimed to compare local AS, by an automatic edge detection system, with pulse wave velocity (PWV), the ''gold standard'' for AS.

In 27 patients (males 16, age 40 ± 7 years) with mild hypertension (HT) and 15 age and gender matched controls (NT), we measured carotid pulse pressure PP and central PWV by applanation tonometry (SphygmoCor®). Diameter changes were measured by a contour tracking algorithm applied to B-mode longitudinal scans of common carotid artery. The algorithm is implemented on a stand-alone video processing system which acquires and analyzes video signal showing results in real-time. Distension (D) was calculated as systolic minus diastolic diameter. Stroke change in lumen area (δA) and lumen area (A) were evaluated from diameter and D values. The cross-sectional distensibility coefficient ($DC=\delta A/(A*PP)$) was converted (Bramwell-Hill equation) into a parameter ($CS=(DC*\rho)^{-1/2}$, $\rho=$ blood density) with same measurement units of PWV.

HT showed a significantly ($p<0.0001$) higher PWV (8.48 ±1.45 m/s) than NT (5.44 ± 0.45 m/s). PP was similar in HT (60 ± 14 mmHg) and NT (58 ± 11). Carotid diameter was higher in HT (7.67 ± 0.67 mm) than NT (6.76 ± 0.40 mm). Carotid stiffness was higher in HT (CS = 7,35 ± 0.93 m/s) than in NT (CS = 5,76 ± 0.74 m/s; $p<0.0001$). PWV correlated with CS ($r = 0.66$; $p<0.0001$).

In conclusion, CS discriminates between HT and NT and is related with PWV. Automatic detection of carotid stiffness from ultrasound provide similar and-or complementary information to central PWV.

P.084
VISCERAL ADIPOSITY AS THE MAIN DETERMINANT OF CAROTID STIFFNESS IN A HEALTHY POPULATION WITH A WIDE BMI AND AGE RANGE: EVIDENCE FROM AN ECHO-TRACKING APPROACH

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Introduction: Aging and blood pressure have been reported to be the main determinants of systemic arterial stiffening but few data exist on factors influencing local arterial stiffness.
Aim: Evaluation of metabolic, hemodynamic and anthropometric determinants of carotid artery stiffness.
Materials: 145 normotensive, non-diabetic, non-dyslipidemic subjects were studied; according to WHO criteria the population included 44 normal 30 overweight and 71 obese subjects [NL, OW, and OB (mean age 40 ± 11.4, 44.4 ± 10, and 39.2 ± 12 yrs, mean BMI 22.6 ± 1.9, BMI 28.2 ± 1.6, and 39.5 ± 6.2 kg/m^2, respectively)]. 106 subjects underwent oral glucose tolerance test; blood samples for glucose, insulin, c-peptide, total HDL- and LDL-cholesterol, and triglyceride levels collected. Carotid artery stiffness was evaluated by a cardiovascular ultrasound system (Aloka SSD-5500) implemented with an echo-tracking subsystem allowing real time evaluation of arterial diameter, and providing calibrated diameter-derived pressure curves. Indices of local arterial stiffness such as pressure-strain elastic modulus (EP), b stiffness index, and pulse wave velocity (PWV), and the augmentation index (AIx) were obtained.
Results: carotid PWV correlated ($p<0.05$) directly with: age ($r=0,407$); SBP, DBP and MBP ($r=0,343$, 0,285 and 0,330, respectively); mean carotid IMT ($r=0,219$), waist-hip ratio (WHR, $r=0,511$); AUC for C-peptide (60 subjects) ($r=0,359$), Framingham risk score ($r=0,319$) and inversely with HDL cholesterol ($r=-0,231$). In stepwise regression analysis WHR remained as main independent determinant of local carotid PWV ($r^2=0,396$, $p<0.001$).
Conclusions: Visceral adiposity is the main determinant of arterial stiffness in a healthy population with wide BMI and age range.

P.085
METABOLIC SYNDROME AND VASCULAR ALTERATIONS IN NORMOTENSIVE PATIENTS AT RISK OF DIABETES MELLITUS

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The aim of the study was to evaluate the possible early vascular abnormalities associated with the presence (MS+) or absence (MS-) of the metabolic syndrome (MS), according to ATP III criteria, in normotensive patients at risk of developing diabetes.

In 77 subjects (age: 50 years), with family history of diabetes, obesity or impaired fasting glucose and blood pressure (BP) < 140/90 mmHg and 50 age-matched healthy subjects, we measured brachial artery flow-mediated dilation (FMD) and response glyceryl trinitrate (GTN). Carotid-femoral pulse wave velocity (PWV) and radial augmentation index (AI) were assessed by applanation tonometry (Sphygmocor).

FMD was similarly reduced (*$p<0.05$) in both MS+ and MS- patients. PWV was higher (** $p<0.01$) in MS+ than in MS- patients and controls. Response to GTN and radial AI were similar.

	MS+ (27)	MS- (50)	Controls (50)
FMD (%)	6.1 ± 3.7%*	5.8 ± 2.7*	6.9 ± 2.5
PWV (m/s)	9.0 ± 1.9**	7.7 ± 1.2	7.2 ± 1.5

PWV significantly ($p<0.05$) increased with the increased number of MS components (from 0 to more than 3). Comparing patients with BP greater (BP+, $n=39$) or lower (BP-, $n=39$) than 130/85 mmHg, PWV was ($p<0.05$) higher in BP+ patients (8.5 ± 1.9 m/s) as compared to BP- patients (7.8 ± 1.9 m/s). FMD was ($p<0.05$) lower in BP+ (5.2 ± 2.6%) than in BP- patients (6.9 ± 1.9%). No differences were found for AI. The other single components did not influence vascular parameters.

In conclusion in normotensive patients at risk of developing diabetes mellitus MS is associated with increased central PWV and only blood pressure values negatively influence arterial stiffness and endothelial function.

P.088
ENDOTHELIAL DYSFUNCTION AND ITS CORRECTION IN SUBCLINICAL THYROTOXICOSIS

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The mechanisms by which thyroid hormones affect vascular physiology are mostly unknown. Nevertheless, few data are available regarding the effects of thyroid hormones on endothelial function. Experimental and clinical results give of conflicting information, but the influence of hyperthyroidism on endothelium-dependent relaxation is connected with the change of production of Nitric Oxide. The effects of subclinical thyrotoxicosis (ST) on endothelial function and possibilition its correction are unknown. ST characterized by low serum TSH and normal FT_4 and FT_3 levels.The present study includes 49 normotensive patients with ST without any CVD (the age of 20-60 years, 5 men and 44 women); mean serum TSH level − 0,09 ± 0,01 mU/l (normal range, 0.4—4.6 mU/l). The control group