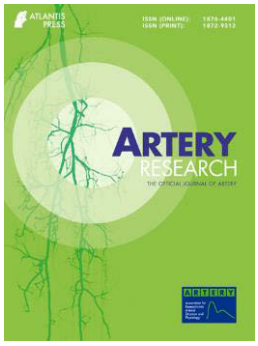

Artery Research

ISSN (Online): 1876-4401 **ISSN (Print): 1872-9312**
Journal Home Page: https://www.atlantis-press.com/journals/artres

P.078: VALIDATION OF A NEW AUTOMATED REAL-TIME MEASURING SYSTEM FOR CAROTID INTIMA–MEDIA THICKNESS ASSESSMENT

F. Faita, C. Giannarelli, V. Gemignani, E. Bianchini, M. Demi, L. Ghiadoni

To cite this article: F. Faita, C. Giannarelli, V. Gemignani, E. Bianchini, M. Demi, L. Ghiadoni (2007) P.078: VALIDATION OF A NEW AUTOMATED REAL-TIME MEASURING SYSTEM FOR CAROTID INTIMA–MEDIA THICKNESS ASSESSMENT, Artery Research 1:2, 70–71, DOI: https://doi.org/10.1016/j.artres.2007.07.012

To link to this article: https://doi.org/10.1016/j.artres.2007.07.012

Published online: 21 December 2019

the effect of smoking on arterial stiffness in white coat hypertensive (WCH) patients has not been investigated yet.
Methods: The study comprised 375 WCH patients (mean age 52 years, 149 male). The diagnosis of WCH was confirmed by a 24h Ambulatory Blood Pressure Monitoring (ABPM) into normal range. The augmentation index (AIx), a measure of arterial wave reflections, was measured by applanation tonometry (SphygmoCor), while carotid-brachial Pulse Wave Velocity (PWVc-r) and carotid-femoral PWV (PWVc-f) were measured with Complior. AIx was corrected for heart rate (AIx_{75}). Current smoking status was assessed with a standardized questionnaire.
Results: The study cohort was divided in 129 smokers and 246 non-smokers, who did not differ in SBP, BMI, heart rate and total cholesterol ($p=NS$). In multivariate analysis after adjusting for age and gender, AIx_{75} was higher in smokers compared to non-smokers (26.8 vs 22.5, $p<0.001$). PWVc-r was also higher in smokers compared to non-smokers (8.3 ± 0.9 vs 8.0 ± 1.2, $p<0.05$), while no significant difference was noticed in PWVc-f. When we examined the correlation of smoking with the arterial stiffness indices, we noticed a significant correlation of AIx_{75} with pack-years ($r=0.278$, $p<0.001$), while the stronger correlation was noticed in years of smoking with PWVc-f ($r=0.425$, $p<0.001$) and with AIx_{75} ($r=0.649$, $p<0.001$). After adjusting for age and gender, the correlation of years of smoking with AIx_{75} remained significant ($r=0.355$, $p<0.0001$).
Conclusion: Smoking affects wave reflections and arterial stiffness in WCH patients. Specifically, intensity/duration of smoking affects both wave reflections and arterial stiffness whereas smoking duration is a burden only to wave reflections.

P.075
TISSUE CHARACTERIZATION OF CAROTID WALL IN MILDLY DISEASED ARTERIES: COMPARISON OF VIDEODENSITOMETRIC ANALYSIS AND INTEGRATED BACKSCATTER

M. Failla [2], C. Morizzo [1], M. Kozàkovà [1], M. Paterni [3], S. Maestroni [2], E. Fantini [2], C. Giannattasio [2], C. Palombo [1], G. Mancia [2]. *[1]Department of Internal Medicine, University of Pisa, Pisa, Italy, [2]Clinica Medica, Milano-Bicocca University, Monza, Italy, [3]CNR Institute of Clinical Physiology, Pisa, Italy*

Background: Integrated backscatter analysis (IBS) is the reference technique for tissue characterization by ultrasound. However, this approach is equipment-dependent, so that its practical use on wide-scale basis is limited. By contrast, videodensitometric analysis (VDA) on 2D images can be performed on standard recordings.
Aim of the study: To compare results of VDA against IBS on common carotid artery wall (CCA) in a study population including normal subjects and patients with cardiovascular risk factors.
Methods: Sixty subjects (fifty males, age 49 ± 11) referred for diagnostic carotid scan, were studied by high resolution system (7.5 MHz linear probe) implemented with acoustic densitometry package for IBS assessment. Diastolic CCA images were acquired bilaterally in 2D mode and IBS. IBS and VDA were performed in regions of interest including the intima-media (IMT), one cm before the flow divider.
Results: On 120 arteries (average IMT 0.71 ± 0.29 mm), mean IBS value (dB) was directly related to mean gray levels ($r = 0.357$, $p< 0.001$). Mean gray levels and their standard deviation correlated each other ($r = 0.71$, $p<0.0001$). A significant relation ($p<0.05$) with age was found for IMT (direct, $r = 0.25$) and mean IBS (inverse, $r = -0.22$), but not for mean gray levels.
Conclusion: VDA of CCA IMT may represent an acceptable surrogate estimate for tissue characterization, of possible interest for multicentre studies. The inverse relation of mean IBS value with age is in keeping with the hypothesis of an age-related atheromasic deposition. IBS may have higher sensitivity in differentiating early atherosclerosis from ''healthy'' arterial aging.

P.076
EFFECTS OF REGULAR TRAINING ON PERIPHERAL ARTERIAL COMPLIANCE IN YOUNG HEALTHY MALES

N. Potocnik, K. Cankar, Z. Melik, V. Starc. *Institute of physiology, Medical faculty, University Ljubljana, Ljubljana, Slovenia*

Physical activity is known to have beneficial effects on prevention of cardiovascular disease. The regular aerobic exercise is associated with higher central arterial compliance, but its effect on peripheral arterial compliance is controversial. The aim of our study was to measure the small artery compliance and its changes provoked by 0.1Hz breathing and mental stress in young healthy males.

Experiments were performed on 21 healthy adults, 19-24 years old (12 physically trained - group A, 11 sedentary controls - group B). We measured ECG, arterial blood pressure and finger artery compliance at rest, 3 minutes during 0.1Hz breathing and 3 min during mental stress. A noninvasive method was used to measure finger artery compliance, compliance index (CI) was calculated. Baroreflex sensitivity (BRS) was determined using the sequential method.

Our results revealed elevated CI in group A compared to group B (3.42 ± 0.30 and 1.28 ± 0.31, $p=0.004$) at rest, but no significant differences in CI between groups during both physiological stimuli. CI decreased during 0.1Hz breathing (1.53 ± 0.20, $p=0.003$) and mental stress (0.87 ± 0.13, $p=0.002$) in group A, but only during mental stress in group B (0.59 ± 0.12, $p=0.03$). BRS did not differ between groups, but was significantly reduced in both groups during mental stress. There were no differences in heart rate, systolic and diastolic blood pressure between groups, neither at rest nor during stimuli.

We conclude that regular aerobic exercise increases peripheral arterial compliance. Surprisingly the increase was not associated with a greater BRS indicating that peripheral mechanisms govern peripheral arterial properties.

P.077
IN VIVO VALIDATION OF A NON-INVASIVELY MEASURED LOCAL PULSE WAVE VELOCITY: IMPROVED PERFORMANCE USING AORTIC VALVE CLOSURE IN STEAD OF AORTIC VALVE OPENING

E. Hermeling, K.D. Reesink, A.P. Hoeks. *Dept. of Biophysics/Biomedical Engineering, Cardiovascular Reseach Institute Maastricht, Maastricht University, Maastricht, Limburg, Netherlands*

Introduction: High resolution multiple M-line ultrasound can be used to obtain local pulse wave velocity, by tracking the propagation of characteristic time-points of the distension waveform over an arterial segment. Local PWV provides a direct estimate of the local arterial stiffness.
Method: The left and right CCA of 12 young subjects was measured with multiple M-line ultrasound, resulting in 14 diameter waveforms spaced over 16.4mm. The second derivative of the distension waveforms was calculated to identify aortic valve opening and closure (AVO and AVC). By performing linear regression on M-line positions versus time-points, the local PWV was estimated. Beats were accepted for further analysis if the regression coefficient exceeded 0.9. The DC was measured using brachial-PP and carotid-distension, giving a reference estimate of the PWV using the Bramwell-Hill equation: $PWV_{DC} = 1/\sqrt{\rho DC}$
Results: PWV_{AVC} (mean = 4.91m/s) showed a better intra-subject precision (0.46m/s) than PWV_{AVO} (mean = 5.21m/s, precision = 1.66m/s). The range of PWV_{DC} (2.8-7.9m/s) is comparable to PWV_{AVC} (3.5-7.3m/s) but not to PWV_{AVO} (2.4-13.2m/s). The correlation between PWV_{DC} and PWV_{AVC} was weak but significant ($r=0.69$, $p<0.001$). No correlation between PWV_{DC} and PWV_{AVO} exists.
Discussion: In contrast to PWV_{AVO}, PWV_{AVC} has an acceptable precision (coefficient of variation less than 10%) and correlates with PWV_{DC}. The poor correlation between PWV_{AVO} and PWV_{DC} estimates may be caused by interference of early arterial wave-reflections leading to a biased estimate of PWV_{AVO}. The correlation between PWV_{DC} and PWV_{AVC} is weak, although carotid-PP may improve DC calculation.

P.078
VALIDATION OF A NEW AUTOMATED REAL-TIME MEASURING SYSTEM FOR CAROTID INTIMA–MEDIA THICKNESS ASSESSMENT

F. Faita [1], C. Giannarelli [2], V. Gemignani [1], E. Bianchini [1], M. Demi [3], L. Ghiadoni [2]. *[1]CNR Institute of Clinical Physiology, Pisa, PI, Italy, [2]University of Pisa, Department of Intenal Medicine, Pisa, PI, Italy, [3]Esaote Spa, Genova, GE, Italy*

Increased carotid intima-media thickness (C-IMT) is a non-invasive marker of early arterial alterations which is associated with increased cardiovascular risk. The aim of this study is to validate a new real-time automatic system to measure C-IMT. Results are compared with the manual measurements, which are still largely accepted as the gold standard.

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

P. Pietri, C. Vlachopoulos, K. Aznaouridis, G. Vyssoulis, A. Tsokanis, A. Baou, C. Stefanadis. *1st Department of Cardiology, Athens Medical School, Hippokration Hospital, Athens, Greece*

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

E. Malshi [1], A. Dallai [2], T. Morganti [2], G. Bambi [2], M. Kozàkovà [1], S. Ricci [2], C. Morizzo [1], P. Tortoli [2]. *[1]Department of Internal Medicine, University of Pisa, Pisa, Italy, [2]Microelectronic Systems Design Lab, Department of Electronic Engineering, University of Florence, Florence, Italy*

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

D. Mahieu [2], E. Rietzschel [2], M. De. Buyzere [2], T. Gillebert [2], P. Segers [1], Van Bortel L [2]. *[1]Ghent University, Gent, Belgium,, [2]Ghent University Hospital, Gent, Belgium*

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

P. Xaplanteris, C. Vlachopoulos, K. Baou, C. Vasiliadou, I. Dima, C. Stefanadis. *1st Department of Cardiology, Athens Medical School, Hippokration Hospital, Athens, Greece*

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