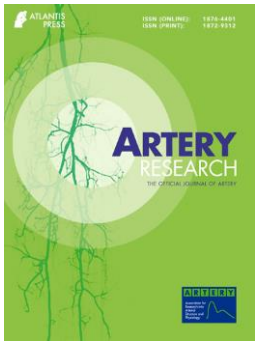


Artery Research

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

P1.33: DETERMINANTS OF THORACIC AORTA REMODELING BY USING CMR AND CAROTIDO-FEMORAL APPLANATION TONOMETRY

M.Z.B. Bensalah, E.B. Bollache, A.R. Redheuil, P.B. Boutouyrie, S.L. Laurent, E.M. Mousseaux

To cite this article: M.Z.B. Bensalah, E.B. Bollache, A.R. Redheuil, P.B. Boutouyrie, S.L. Laurent, E.M. Mousseaux (2013) P1.33: DETERMINANTS OF THORACIC AORTA REMODELING BY USING CMR AND CAROTIDO-FEMORAL APPLANATION TONOMETRY, Artery Research 7:3_4, 118–119, DOI: https://doi.org/10.1016/j.artres.2013.10.062

To link to this article: https://doi.org/10.1016/j.artres.2013.10.062

Published online: 14 December 2019

P1.28 Withdrawn by author

P1.29
CARDIO-ANKLE VASCULAR INDEX, LEFT VENTRICULAR SYSTOLIC DYSFUNCTION AND INAPPROPRIATE LEFT VENTRICULAR MASS

G. Schillaci, F. Battista, G. Pucci
Università di Perugia, Medicina Interna, Terni, Italy

The relation between carotid-femoral pulse wave velocity (cfPWV) and LV remodeling/dysfunction is confounded by the effect of blood pressure (BP). We evaluated the relationship between cardio-ankle vascular index (CAVI), a less BP-dependent measure of the stiffness constant (β) of the aorta, iliac, femoral and tibial arteries, and prognostically relevant measures of LV structure and systolic function.
In 119 subjects with hypertension or high-normal BP (34% treated; 56±16 years, BP 144/89±21/12 mmHg), we measured CAVI and cfPWV, and LV mass and systolic function at echocardiography.
cfPWV had a direct association with SBP/DBP ($r=0.33/0.25$, $p<0.001/<0.01$), while no significant association was found between CAVI and SBP/DBP ($r=0.15/-0.02$, both $p>0.1$). Both CAVI and cfPWV had direct univariate relationships with LV mass index ($r=0.38$, $p<0.001$; $r=0.24$, $p=0.014$). The subjects with inappropriately high LV mass for a given cardiac workload ($n=36$) had a higher CAVI (9.0±1.7 vs 7.6±1.4, $p<0.001$), but not a higher cfPWV (8.0±1.7 vs 8.3±2.3, $p>0.1$). In a multivariate stepwise linear regression model, CAVI was an independent predictor of inappropriate LV mass ($\beta=0.44$, $p<0.001$), along with body mass index. CAVI also showed a negative relation with LV midwall fractional shortening ($r=-0.41$, $p=0.001$), which was independent of age, sex, BP, and LV mass in a multivariate analysis.
We conclude that CAVI has a significant association with inappropriately high LV mass and LV systolic dysfunction. Our data suggest that pressure-independent stiffness constant (β), a marker of arterial diastolic-to-systolic stiffening, may have an impact on LV structure and function.

P1.30
DIFFERENTIAL MEANING OF RETINAL ARTERIAL REMODELING AND AORTIC DISTENSIBILITY IN YOUNG HYPERTENSIVES

D. Rosenbaum [1,2], A. Redheuil [2], N. Kachenoura [2], P. Cluzel [2], A. Decesare [2], E. Koch [3], M. Paques [3], X. Girerd [1]
[1]*Pitié salpêtrière Hospital, Cardiovascular Prevention Unit, Paris, France*
[2]*Laboratoire d'imagerie fonctionnelle, UPMC INSERM U 678, Paris, France*
[3]*Institut de la vision, CIC des XV/XX, Paris, France*

Objectives: Microvascular arterial remodelling has been linked with target organ damage and cardiovascular events. Our objective was to link retinal arterial remodelling assessed using a new interferometry technique (adaptative optics, AO) and ascending aortic function and geometry.
Methods: 9 patients (median age 43, range 30 to 58, 60% male) with primary hypertension underwent AO to measure retinal arteries wall to lumen ratio (WLR) index and a cardiovascular magnetic resonance exam (1.5T Siemens) of the proximal aorta. Ascending aortic diameters and strain were calculated using the ARTFUN software and an automated segmentation of SSFP cine acquisitions acquired in the axial view, during breath-holding, at the level of pulmonary bifurcation perpendicular to the aorta. Aortic strain was used to calculate aortic distensibility in each subject: distensibility (AD) =strain/cPP where cPP is the central pulse pressure obtained by tonometry (sphygmocor®). Home Blood pressure (hBP) records were used to define BP levels
Results: Characteristics of the population are shown in table 1. In univariate analysis, retinal WLR was linked to systolic hBP ($r= 0.53$, $p= 0,006$) and weight ($r= 0.38$, $p= 0,03$) but not with any other risk factors. AD was linked to age ($r= 0.53$, $p= 0,006$), systolic hBP ($r= 0.53$, $p= 0,006$) and tobacco status. In multivariate analysis, the only significant determinants remaining were age for AD and systolic hBP for WLR.
Conclusion: In young hypertensives, AD and WLR are representative of 2 different arterial aging factors: age for AD and hypertension for WLR.

P1.31
A COMPARISON OF THE POPLITEAL AND CAROTID ARTERIES IN YOUNG AND OLDER CAUCASIAN MEN AND WOMEN

J. M. Van Rooyen, L. J. Kotzee, R. Kruger, C. M. C. Mels, A. Burger
Hypertension in Africa Research Team, North-West University, Potchefstroom Campus, Potchefstroom, South Africa

Objectives: The popliteal artery resemble the carotid artery in structure and function[1]. The aim of this study was to determine whether the popliteal artery resemble the carotid artery in structure and function in young and older Caucasian men and women.
Methods: Hundred and twenty Caucasian men and women were equally divided into four groups according to age (20-30; 40-60 years). A general health questionnaire were completed by the participants. Cardiovascular and anthropometric measurements were executed which included blood pressure, carotid femoral PWV (Complior SP Acquisition system) as well as popliteal and carotid IMT (Vivid E9, GE).
Results and conclusion: We observed an inverse association ($r=-0.60$; $P=0.001$) between popliteal IMT and c-fPWV in young men after adjusted for age, BMI and smoking with no association found in older men, young and older women. We also encountered a positive association between the carotid IMT and popliteal IMT ($r=0.44$; $P=0.02$) only in young women. Mean CSWA of the carotid artery differed significantly from the popliteal CSWA amongst the men (2.31 cm^2 vs. 1.91 cm^2; $P=0.001$) and the younger women (1.71 cm^2 vs. 1.47 cm^2; $P=0.048$). We concluded that popliteal and carotid arteries, in young and older Caucasian men and women, do not exhibit similar structural or functional properties.
Reference
1. Debasso R, Åstrand H, Bjarnegård N, Ahlgren ÅR, Sandgren T, Länne T. The popliteal artery, an unusual muscular artery with wall properties similar to the aorta: Implications for susceptibility to aneurysm formation. J of Vasc Surg. 2004; 39(4): 836-842.

P1.32
THE HIGH DOSE ATORVASTATIN TREATMENT ALLOWS TO ACHIEVE ECHOLUCENT SYMPTOMATIC CAROTID PLAQUE STABILIZATION

O. V. Tereshina [1], E. A. Surkova [1], A. N. Vachev [1]
[1]*Samara State Medical University, Samara, Russian Federation*

Background: Statins are widely used for atherosclerotic plaques stabilization due to their cholesterol-lowering properties and pleotropic effects. However, the optimal drug regimens including dosage and length of treatment necessary to achieve significant improvement of ultrasound plaque morphology are still widely debated.
Methods: A total of 62 patients with carotid artery stenosis less than 60%, recruited prospectively in the current study, were divided into two groups. Patients of group 1 ($n=32$) were treated with 80 mg daily atorvastatin and patients of group 2 ($n=30$) were administered 20 mg daily atorvastatin. Plaque standardized gray scale medians (GSM) were measured in longitudinal ultrasound images to quantitate echolucency before and after 1 month treatment in all patients. Levels of cholesterol, low-density lipoproteins and C-reactive protein in serum were assessed.
Results: In group 1, a significant decrease of total cholesterol and low-density lipoproteins was observed after one month of treatment (up to 44% and 41%, respectively) while reduction in C-reactive protein levels was observed in both groups. GSM score was remarkably increased in both groups, but that augmentation was greater in group 1 (from 33.3±16.5 to 99.4±23.1) than in group 2 (from 35.9±15.6 to 76.1±21.7). No significant changes in the degree of carotid stenosis were detected in any group.
Conclusion: Aggressive high-dose lipid-lowering treatment is more effective than smaller dose one to achieve sustainable carotid plaque stabilization. Other positive effects of one month high dose statin treatment include stabilization of cholesterol levels, control of inflammatory response, and improvements in carotid arterial plaques morphology.

P1.33
DETERMINANTS OF THORACIC AORTA REMODELING BY USING CMR AND CAROTIDO-FEMORAL APPLANATION TONOMETRY

M. Z. B. Bensalah [1,2], E. B. Bollache [1], A. R. Redheuil [1,2], P. B. Boutouyrie [3], S. L. Laurent [3], E. M. Mousseaux [1,2,3]
[1]*Laboratoire d'Imagerie Fonctionnelle U678 Hospital Pitié Salpêtrière, Paris, France*
[2]*Geoges Pompidou Hospital, Paris, France*
[3]*INSERM UMR 970, PARCC, Paris, France*

Objectives: estimate determinants of thoracic aorta remodelling in healthy subjects.
Methods: 139 subjects (63 women, mean age 39.9) were included. Aortic diameters were calculated at the level sinuses of Vasalva, junction, ascending, arch and descending aorta. AIx, Pi, central blood pressure (CBP) and carotido-femoral (CF) PWV were assessed by tonometry, aortic flow and PWV by using phase contrast MR. Aorta impedance was calculated.
Results: Age, sex and BSA were the main determinants of the aortic diameters-DCBP for the tube ($p=0.018$), aortic arch ($p=0.04$) and descending aorta ($p=0.003$); Zci for aortic arch ($p=0.001$) and descending aorta ($p=0.002$) and

AIx for the junction ($p=0.001$), tube ($p=0.011$) and aortic arch ($p=0.016$) after adjustment to age sex and BSA. No independent relationship other functional parameters except for Pi and SCBP at the level of the descending aorta ($p<0.05$).
Conclusion: Aortic diameters were found to be related strongly to age, BSA, sex, and weakly to Zci, Aix and DCBP.

P2 Methods 1

P2.01
HIGH RESOLUTION IMAGING OF SMALL ARTERIES IN THE HUMAN RETINA DURING HYPERTENSIVE RETINOPATHY

M. Paques [2], E. Koch [2], X. Girerd [1], F. Rossant [3], D. Rosenbaum [1], J. Benesty [2], J. Sahel [2], P. Chaumet-Riffaud [2]
[1]*Cardiovascular Prevention Unit, Pitié Salpêtrière Hospital, Paris, France*
[2]*Clinical Investigation Center 503, Paris, France*
[3]*SEP, Paris, France*

Objective: Morphological changes affecting small arteries are recognized surrogates of end-organ damage due to aging and/or hypertension. However, the corresponding structural modifications of the wall of microvessels are poorly known. Here, using adaptive optics (AO) infrared imaging, we analyzed the vascular microstructures in subjects with various degree of hypertensive retinopathy.
Methods: The wall-to-lumen ratio (WLR) of the superotemporal artery was measured in 40 normotensive or treatment-naïve hypertensive subjects using a semi-automated procedure. Areas of focal vascular damage were also analyzed.
Results: Intra- and interobserver reproducibility was high (ICC over 0.8 for all parameters measured). In treatment-naïve subjects, the WLR of the superotemporal artery (mean ± SD 0.31 ± 0.08) was independently correlated with diastolic blood pressure ($p<0.01$), and lumen diameter ($p<0.01$). Neither focal arteriolar narrowing (FANs; $n=10$) or arteriovenous nicking (AVNs; $n=12$) showed parietal thickening. Instead, at sites of FANs, a reduction of the outer diameter was consistently found, while at sites of AVNs venous narrowing and retinal opacification were observed distal to the arteriovenous interface. In addition, in four cases of AVNs the absence of arteriovenous contact could be unequivocally demonstrated.
Interpretation: AO imaging allows a reproducible analysis of the lumen diameter and parietal thickness of retinal vessels. Parietal thickness of retinal arterioles was correlated to blood pressure, but not focal lesions which appeared to involve either focal vasoconstriction and/or periarteriolar changes. AO imaging may thus contribute to a better understanding of end-organ damage linked to microvasculopathy.

P2.02
IN VIVO VISUALISATION AND RECONSTRUCTION OF THE MOUSE CEREBRAL VASCULATURE USING CONTRAST ENHANCED MICRO-CT

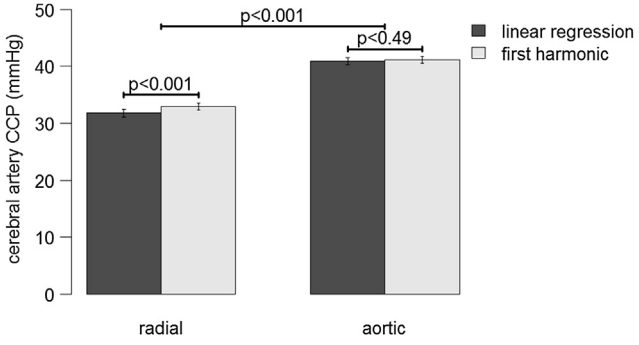
D. De Wilde [1], B. Trachet [1], C. Van der Donckt [2], B. Vandeghinste [3], B. Descamps [3], R. Van Holen [3], C. Vanhove [3], G. R. Y. De Meyer [2], P. Segers [1]
[1]*BioMMeda, Ghent University - IBiTech, Ghent, Belgium*
[2]*Division of Physiopharmacology, University of Antwerp, Antwerp, Belgium*
[3]*MEDISIP-Infinity, Ghent University — iMinds — IBiTech, Ghent, Belgium*

Introduction: Recently, a mouse model was developed showing spontaneous plaque rupture leading to stroke ($ApoE^{-/-}Fbn1^{C1039G+/-}$ mouse). However, a longitudinal follow-up of these mice was hampered by the lack of an accurate in vivo method to visualize the cerebral vasculature.
Methods: In this feasibility study, a female $ApoE^{-/-}Fbn1^{C1039G+/-}$ and an $ApoE^{-/-}$ (control) mouse (stable plaques) were fed a western-type diet for up to 20 weeks. At week 10, 15 and 20 after the start of the diet CT-scans were performed before and after injection of a gold-nanoparticle contrast agent (Aurovist®, Nanoprobes, New York, USA). Image reconstruction was based on the iterative maximum-likelihood polychromatic algorithm, to reconstruct high quality images at 50-μm. Post- and pre- contrast injection images were co-registered and subtracted, using 3Dslicer, resulting in angiographic images. These images were segmented by executing a Frangi vesselness filtering, an isosurface extraction and a geodesic evolution step in VMTK.
Results: It was feasible to obtain a 3D-visualisation of the mouse cerebral vasculature (see figures for the $ApoE^{-/-}Fbn1^{C1039G+/-}$mouse) up to vessels of 0.15 mm diameter. Interestingly, at week 15 and 20 contrast agent from previous injections was still present in plaques (presumably taken up by macrophages), allowing us to determine plaque position and progression over time. More severe stenosis was observed in the $ApoE^{-/-}Fbn1^{C1039G+/-}$mouse compared to the control mouse.
Conclusions: The described in vivo method enabled us to generate detailed 3D reconstructions of the mouse cerebral vasculature, including presence of atherosclerotic plaques. Future work will include numerical models of the blood flow.

P2.03
AORTIC, BUT NOT RADIAL PRESSURE GIVES A MODEL INDEPENDENT ESTIMATE OF CEREBRAL ARTERY CRITICAL CLOSING PRESSURE

M. O. Kim [1], M. Butlin [1], Y. Li [2], F. Wei [2], J. Wang [2], M. O'Rourke [1,2], A. P. Avolio [1]
[1]*Australian School of Advanced, Macquarie University Sydney Australia*
[2]*Ruijin Hospital, Shanghai, St. Vincent's Clinic, Sydney*

Objectives: Cerebral artery critical closing pressure (CCP) is an estimated parameter with no single accepted method of calculation. Variation between methods could be significant. This study investigates two models to estimate CCP using arterial blood pressure (BP) and middle cerebral artery flow velocity (FV) waveforms, quantifying the difference between radial and aortic BP as the BP input signal.
Methods: Suspected and untreated hypertensive subjects ($n=445$, 203 female, 50±10 years, range 21 to 73 years old), referred to Ruijin Hospital in Shanghai, China, for 24-hours BP monitoring, were recruited. Radial BP and FV waveforms were acquired by applanation tonometry and transcranial Doppler respectively. Aortic BP waveforms were synthesised from the radial waveform using a validated transfer function (SphygmoCor®). CCP was estimated using the relationship between BP and FV waveforms by both linear regression (LR), and the first harmonic (H1) in Fourier decomposition. The difference between the two models was quantified if the BP waveform input signal was radial or aortic and compared by Student's paired t-test.
Results: Use of aortic instead of radial BP resulted in a 29% increase in estimated CCP using the LR model, and 25% increase using the H1 model (Figure, $p<0.001$). Radial BP resulted in variation between the models (4%, $p<0.001$). Aortic BP did not cause this variation (0.6%, $p=0.49$).
Conclusions: Aortic, but not radial pressure gave a model independent estimate of CCP. However, estimated CCP within a model was significantly different depending on whether radial or aortic pressure was used.



P2.04
ASSESSMENT OF BRACHIAL ARTERY REACTIVITY USING THE ENDOCHECK: REPEATABILITY, REPRODUCIBILITY AND PRELIMINARY COMPARISON WITH ULTRASOUND

L. M. Day, K. M. Maki-Petaja, I. B. Wilkinson, C. M. McEniery
University of Cambridge, Cambridge, United Kingdom

Objective: The Endocheck, embedded within the Vicorder device, uses cuff-based, pulse volume (PV) displacement to record brachial PV waveforms at baseline, and during reactive hyperaemia. The aim of this study was to assess the utility of the Endocheck method.
Methods: The study consisted of two parts. Part 1: Healthy volunteers ($n=9$) were studied twice, separated by 24hours. Each visit consisted of two studies, 30min apart, where, after 10min supine rest, brachial BP was assessed and PV waveforms recorded for 10sec (baseline). A cuff placed distally around the forearm was then inflated to 200mmHg for 5min. Following cuff-release, PV waveforms were recorded for 3min. The square root of the ratio of peak:baseline PV during hyperaemia ($\sqrt{V2/V1}$) was calculated. Part 2: Healthy volunteers ($n=16$) were studied once. Brachial artery responses were assessed simultaneously in both arms, using ultrasound (right arm) and Endocheck (left arm), following a similar protocol as above.