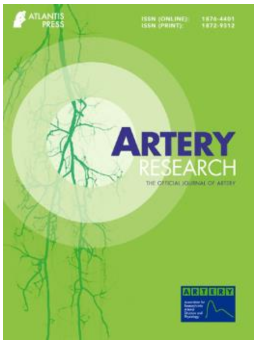

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P6.03: THE PRESSURE DEPENDENCE OF ARTERIAL STIFFNESS AS A NOVEL VASCULAR MARKER DETERMINED FROM PWV AND BRACHIAL BP TAKEN AT DIFFERENT ARM HEIGHTS

G. Schillaci, B. Gavish, G. Pucci, L. Settimi, E. Mannarino

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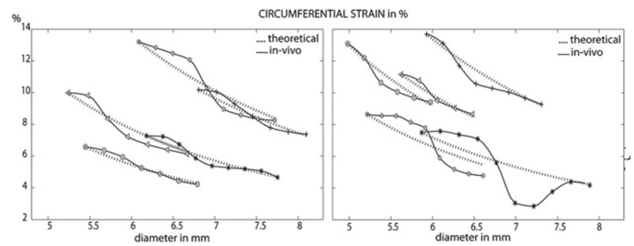
blood flow, arterial wall deformation and ultrasound physics and imaging of a physiological realistic common carotid artery, it was revealed that this S-shape finds its origin in so-called specular reflections, arising at tissue-transitions (tissue/wall and wall/lumen), clouding the measurement in their neighbourhood.

Conclusion: We demonstrated using in-vivo data and simulations that the physics behind ultrasonic wall tracking hamper the precision of distension and derived strain estimates in the common carotid artery.



P6.03

THE PRESSURE DEPENDENCE OF ARTERIAL STIFFNESS AS A NOVEL VASCULAR MARKER DETERMINED FROM PWV AND BRACHIAL BP TAKEN AT DIFFERENT ARM HEIGHTS

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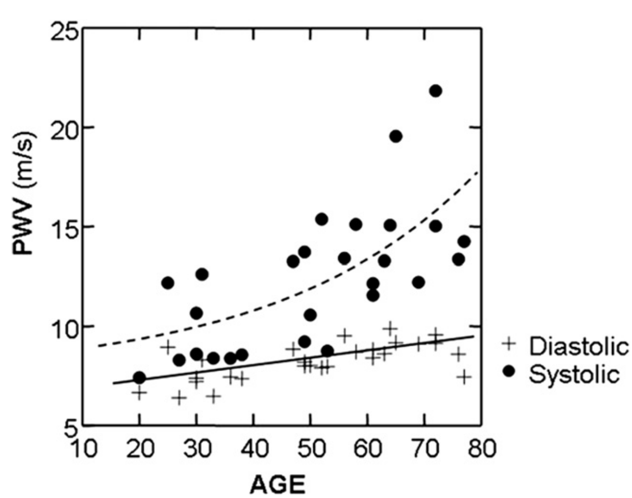
Background: The increase of arterial stiffness with blood pressure (BP) reflects the nonlinear increase of arterial pressure with volume. Stiffness can be represented by the square of the pulse wave velocity (PWV), and is currently measured for diastolic BP (DBP). By analyzing the changes in DBP and diastolic PWV (PWVd) induced by changing arm position, we evaluated a linear relation between stiffness and DBP in an individual subject.

Methods: In 27 healthy subjects (66% men, age 51±17 years, BP 134/78±17/12 mmHg), we measured brachial BP and carotid-radial PWVd in supine position with arm supported at 3 postures: below-, at- and above the heart level. $PWVd^2$ was expressed by the model 0.127×β(DBP - α), where β and α were best fitted for each subject, and then used for determining the systolic stiffness $PWVs^2$ from the SBP, according to the model 0.127×β(SBP - α). β ("stiffness constant") expresses the steepness of the pressure-volume exponential curve.

Results: $PWVd^2$ highly correlated with DBP for individual subjects (r=0.95±0.03). The mean β was 13.1±11.7 and increased significantly at older age (r=0.49). While diastolic PWV increased linearly with age with r=0.64, calculated systolic PWV increased with age exponentially with r=0.65 that became steep over age 50 years (Figure; all p<0.001).

Conclusions: (1) The gravity effect on brachial DBP induces linear changes in diastolic PWV, which increase with age. (2) The dynamic changes of PWV and DBP may provide a novel and simple determination of systolic PWV, which shows greater age sensitivity than diastolic PWV.



P6.04

RELATIONSHIP BETWEEN AORTIC STIFFNESS AND A LOCAL PULSATILE INDICE FROM THE PERIPHERAL CUTANEOUS MICROVASCULATURE

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Purpose: Increase in arterial stiffness could increase the transmission of pulsatile flow energy and potentially damage the downstream microcirculation. The study of changes in the microcirculatory pulsatility could help to improve our understanding on the deleterious effect of the upstream arterial stiffness. To achieve this goal, we studied the relationship between aortic stiffness, local stiffness (β indice) and distensibility (Ep) of carotid and a local microcirculatory pulsatility index (μFP).

Methods: Aortic stiffness was determined from the carotid-femoral pulse wave velocity (PWV) measured by tonometry (Pulse Pen). Carotid stiffness was measured by echotracking (e-tracking, Aloka) and forearm skin blood flow was recorded by laser Doppler flowmetry (LDF). Data were recorded in subjects (n=17, 15 men, mean age 45±SD8 years) without hypertension, diabetes or obesity. The μFP index was calculated as: (LDF max − LDF min) / mean LDF over 35 cardiac cycles.

Results: A significant positive correlation was found between PWV, μFP and age (R^2= 0.42, p<0.01 - R^2= 0.32, p<0.05) and between PWV and the μFP index (R^2= 0.32, p<0.05 adjusted by age). No significant correlation was found between β stiffness indice (R^2 = 0.0002), Ep (R^2=0.03) and μFP.

Conclusion: Our data show that the pulsatility of the microvascular flow, an easily determined indice, is highly correlated to the aortic stiffness but not to medium-sized artery. These preliminary data have important implication for the further understanding of the deleterious effects of the segmental arterial stiffness on the end-organ microvasculature.

P6.05

VALIDITY AND REPRODUCIBILITY OF A NEW METHOD TO ESTIMATE CENTRAL BLOOD PRESSURE FROM THE UPPER ARM CUFF OSCILLOMETRIC SIGNAL

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Background: Central BP is an independent predictor of mortality. Current methods for non-invasively estimating central BP are operator-dependent and require skill to obtain quality recordings. The aims of this study were firstly, to determine the validity of an automatic, upper arm oscillometric cuff method for estimating central BP (O_{CBP}) by comparison with the non-invasive reference standard of radial tonometry (T_{CBP}). Secondly, we sought to determine the intra-test and inter-test reproducibility of O_{CBP}.

Methods: To assess validity, central BP was estimated by O_{CBP} (R6.5B Vascular Monitor) and compared with T_{CBP} (SphygmoCor) in 47 participants aged 57±9 years in supine, seated and standing postures. Brachial mean arterial pressure and diastolic BP from the O_{CBP} device was used to calibrate both devices. Duplicate measures were recorded in each posture on the same day to assess intra-test reliability and participants returned within 10±7 days for repeat measurements to assess inter-test reliability.

Results: There was a strong correlation (ICC=0.987, p<0.001) and small mean difference (1.2±2.2 mmHg) for central systolic BP determined by O_{CBP} compared with T_{CBP}. Ninety-six percent of all comparisons (n=495 acceptable recordings) were within 5 mmHg. With respect to reproducibility, there were strong correlations but higher limits of agreement for the intra-test (ICC=0.975, p<0.001, mean difference 0.6±4.5mmHg) and inter-test (ICC=0.895, p<0.001, mean difference 4.3±8.0 mmHg) comparisons.

Conclusions: Estimation of central systolic BP using cuff oscillometry is substantially equivalent to radial tonometry and has good reproducibility. As a non-invasive, relatively operator-independent method, O_{CBP} may be useful for estimating central BP in clinical practice.