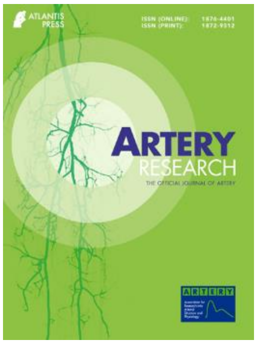

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P2.27: LOCAL RADIAL STRAIN OF THE COMMON CAROTID ARTERY WALL

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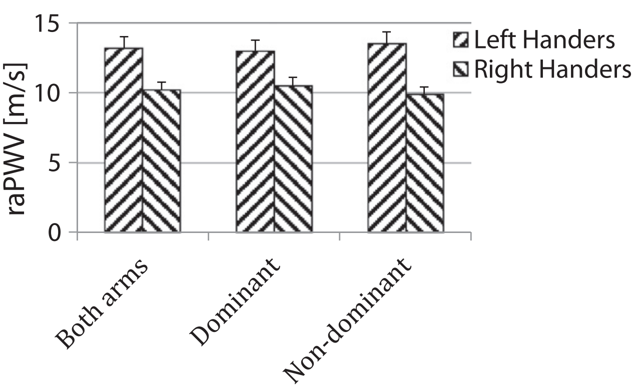
There was no statistically significant correlation between raPWV and arm musculature. 3)Left handed individuals had higher raPWV than right handers, figure below. (unpaired t-test; both limbs PWV $p<0.0001$, dominant only $p<0.015$, non-dominant $p<0.001$).

Summary and Conclusions: Results failed to support hypotheses 1 and 2, although differences in muscularity between the two arms were small. Intriguingly, for reasons unknown, left handers had stiffer arms than right handers. In future we will measure PWV at other sites and include racquet sport players with greater muscular disparity between each arm.



P2.26

PRESSURE AT THE LAST SYSTOLIC SHOULDER OF THE ARTERIAL WAVEFORM EQUALS CENTRAL AORTIC SYSTOLIC PRESSURE AND IS CONSTANT ALONG THE UPPER LIMB

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Objective: Previous studies have shown that the pressure at the late systolic shoulder (SBP_2) of the radial or digital pressure waveform is a good estimate of central systolic pressure (cSBP) when waveforms are calibrated from invasive measurements. These results suggest SBP_2 may remain constant along the upper limb. The aim of this study was to examine the agreement between SBP_2 at the carotid, brachial and radial arteries.

Methods: We compared measurements of SBP_2 obtained by applanation tonometry using the SphygmoCor system (Atcor Medical, Australia) at the radial (RA), brachial (BA) and carotid (CA) arteries on 45 subjects (24 men, aged 23-84 years). Waveforms were calibrated using the same mean (MAP) and diastolic blood pressure (DBP).

Results: There was a close agreement between SBP_2 values measured at the different sites with a mean difference (SD) of 0.88 (5.29) mmHg for RA-BA, -2.30 (4.60) mmHg for BA-CA and -1.42 (4.34) mmHg for RA-CA.

Conclusion: These results suggest that SBP_2 can be considered as constant along the arm.

P2.27

LOCAL RADIAL STRAIN OF THE COMMON CAROTID ARTERY WALL

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Background: Rupture of atherosclerotic plaques occurs when mechanical stress exceeds material strength. Increased radial strain (ε, measured in the wall tissue) may be indicative for both locally increased mechanical stress as well as locally decreased material strength. The aim of our feasibility study was to analyse the precision and accuracy of ε, within the common carotid artery (CCA) wall of patients with and without recent cerebrovascular accident (CVA,<6weeks).

Methods: The left and right CCA of 21 patients (15 with CVA) were measured twice with multiple M-mode ultrasound. ε was determined for the intima-media layer (ε_m) and adventitia layer (ε_a), separately, using an RF-based algorithm. Intima-to-intima ($(\Delta D/D)_{in}$) and adventitia-to-adventitia relative distension ($(\Delta D/D)_{out}$) were also obtained, which are strongly related to strain ($\varepsilon \approx -\Delta D/D$) when wall-inhomogeneities are negligible.

Results: Intra-subject precision was 1.8% for ε_m and 1.0% for ε_a. Averaged over all patients, $\varepsilon_m=-7.4\pm2.7\%$ (mean±sd) was higher than $\varepsilon_a=-3.9\pm1.7\%$ ($p<0.0001$). ε_m was significantly correlated with $(\Delta D/D)_{in}$ ($r^2=0.48$, $p<0.0001$), but higher than $-(\Delta D/D)_{in}$ ($\Delta=0.8\pm2.1\%$, $p=0.02$). For the adventitial layer, the correlation between ε_a and $(\Delta D/D)_{out}$ was weaker ($r^2=0.10$, $p=0.05$; $\Delta=0.7\pm2.0\%$, $p=0.02$). Despite similar blood pressures and stenosis degrees, ε_m, $(\Delta D/D)_{out}$, $(\Delta D/D)_{in}$, but not ε_a, were higher at the ipsilateral side for patients with than for patients without CVA, ($p=0.002$, $p=0.05$ and $p=0.06$, respectively).

Conclusion: Strain can be measured directly within wall tissue with reasonable accuracy and precision and allows discrimination between arterial layers and patient groups. As $\Delta D/D$ is not applicable to inhomogeneous walls, strain is a promising tool to evaluate vulnerability of plaques.

Table Radial strain and relative distension between patients with and without CVA

	N#	SBP (mmHg)	DBP (mmHg)	stenosis degree(%)	ε_m (%)	ε_a (%)	$(\Delta D/D)_{in}$ (%)	$(\Delta D/D)_{out}$ (%)
ipsilateral	14	136±22	77±12	38±36	−8.5±2.5*	−4.3±1.3	7.2±2.9	5.1±2.0*
contralat.	15			28±33	−7.8±2.6*	−3.8±1.2	7.1±2.7	4.9±1.6
w/o CVA	10	145±18	85±10	27±29	−5.3±1.8	−3.5±2.5	5.1±2.1	3.6±1.4

*significant different from patient without (w/o) CVA using Student t-test; number of CCAs (N); systolic blood pressure (SBP); diastolic blood pressure (DBP); contralat, contralateral. [#]1 ipsilateral CCA of patients with CVA and 2 CCAs in patients without CVA were excluded due to poor image quality.

P2.28

OPTICAL AND MECHANICAL MEASUREMENT OF THE ARTERIAL ELASTICITY

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The photoplethysmography (PPG) derives from the change of attenuation of the light either transmitted or reflected through the tissues over which the LED light has been applied. Variation in light intensity received by the photodetector depends on the amount of blood in arteries, but the accurate waveform is also caused by arterial wall properties, e.g., arterial elasticity. Also eletromechanical film (EMFi) is an excellent sensor material for long-term applications for arterial pulse wave recordings to find out wall elasticity. The EMFi sensor measures extremely small displacements of the arterial wall and the tissue around the artery caused by the blood pressure wave signal. Comparison between the EMFi and PPG sensor shows a very close correlation inside of the pulsatile component of blood flow mechanically in the wrist and the change in light absorption on the fingertip. It is possible to separate mathematically five distinct components of the PPG and EMFi waveforms. Potentially from these non-invasively measured information about cardiac function and arterial