Chemical fixation alters the macro- and micro-structure and mechanical behaviour of the common carotid artery

Results: *Reproducibility* -Baseline PWV and FMS% showed good reproducibility (CV 3.3% & 7.2% respectively). There was no correlation between baseline brachial artery diameter and PWV visit 1 r=0.325 p=0.113 visit 2 r=0.335 p=0.192 or FMD and FMS visit 1 r= 0.27 p=0.192 visit 2 r=-0.425 p= 0.053. *Ischaemia Reperfusion* — There was a significant decrease in FMD following IR (-28.5% p=0.04). The trend to a reduction in FMS post-IR was not significant (-13.2% p=0.112). Following lipoprotein apheresis there was a 28.2% increase in FMS (from 18.8% to 24.1% p=0.006).
Conclusions: FMS is a reproducible technique. The ability of the method to detect changes in endothelial function shows considerable promise but requires further investigation.

P2.08
ESTIMATION OF LONGITUDINAL WALL MOVEMENT IN COMMON CAROTID ARTERY USING ROBUST BLOCK-MATCHING WITH AN EXTRA BLOCK

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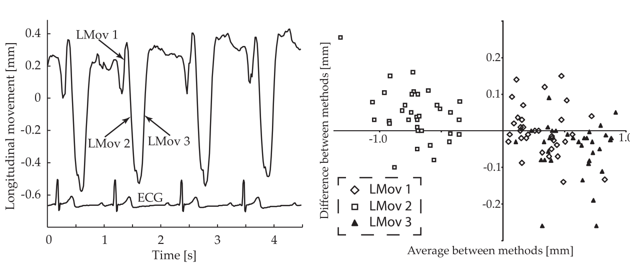
Technological developments made it possible to detect a longitudinal motion of the arterial wall. Our previously presented method can estimate this motion with high accuracy, but the method requires ultrasound images of very high quality. The aim of this study was to evaluate a novel method for estimating the longitudinal movement with respect to both robustness and accuracy.
The developed method uses ultrasound B-mode information to give a sub-pixel estimation of the movement of an area chosen in a cineloop. The method was evaluated in vivo on the right common carotid artery of healthy volunteers (2 measurements each on 10 males; age 27—57 years and 10 females; age 25—49 years).
Figure 1 shows the longitudinal arterial wall movement of one volunteer. Three phases of longitudinal wall movement can be detected; an antegrade movement (LMov1) in early systole, a following retrograde movement (LMov2), and a subsequent antegrade movement (LMov3). The magnitude of the three phases of movement was mean 312 μm (SD 197), -706 μm (222) and 577 μm (218), respectively. The intra-observer variation for the different phases of movement was 21%, 13%, and 17%, respectively, compared to 14%, 13%, and 16% using our previously presented method. Figure 2 shows a Bland-Altman plot comparing the two methods. While the new method could make estimations in all cineloops, our previously presented method failed in six of them.
The study shows that the new method seems to be more robust than our previously presented method with similar tracking accuracy.



P2.09
CHEMICAL FIXATION ALTERS THE MACRO- AND MICRO-STRUCTURE AND MECHANICAL BEHAVIOUR OF THE COMMON CAROTID ARTERY

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Background: Arterial stiffening is an important predictor of cardiovascular risk. In order to identify the pathogenic mechanisms it is necessary to characterise arterial micro-structure and —mechanical properties. Here, we test the hypothesis that chemical fixation (employed in microscopical preparation regimens) may adversely influence arterial structure and stiffness.
Methods: Common carotid arteries (CCA) from young male Wistar rats (225-250g, n=4) were excised. Gross stiffness was determined by wire myography for arterial segments untreated (CON), pre-treated by paraformaldehyde fixation (4%)(FIX) or snap frozen (FRZ). Cryo-sections 5μm thick were prepared from bisected fixed (FIX) or untreated (CON), frozen CCA. Acoustic wave speed (related to tissue elastic modulus) was then characterised by scanning acoustic microscopy (SAM) whilst vessel morphology was quantified from H&E stained sections.
Results: Fixation increased both medial layer thickness (CON 38±3, FIX 55±10 μm, P<0.05) and lamellar spacing (CON 11±4, FIX 15±6 μm, P<0.05) but had no effect on lumen diameter (CON 331±2, FIX 314±29 μm, P>0.05). Fixation significantly increased incremental elastic modulus whilst freezing alone had no effect (CON 0.86±0.15, FIX 1.39±0.10, FRZ 0.99±0.04μm, P<0.05). SAM demonstrated increased stiffness with fixation (CON 1697±21, FIX 1776±32 ms^{-1}, P<0.05) which was pronounced within the inter-lamellar regions (inter-lamellar CON 1629±9, FIX 1678±10 ms^{-1} P<0.05).
Conclusions: The chemical fixation steps commonly used in microscopical preparation regimens can induce localised changes in the structure and stiffness of arterial compartments. We suggest therefore that cryo-preservation, which preserves the gross-mechanical behaviour of the intact artery, may also maintain the micro-structural and micro-mechanical characteristics of the vessel.

P2.10
CUFF-BASED ASSESSMENT OF CAROTID-FEMORAL PULSE WAVE VELOCITY: COMPARISON WITH A WIDELY-USED TONOMETRIC METHOD

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Objective: To compare measurements of carotid-femoral pulse wave velocity (PWV) using two cuff-based devices (Vicorder and XCEL), with a widely-used tonometric method (SphygmoCor).
Methods: Comparative measurements of PWV were made using the SphygmoCor, XCEL and Vicorder devices in 91 individuals (mean±SD age 62±18 years; range 20-89 years). All path length and PWV measurements were made as per manufacturers' instructions, following at least 10min supine rest. Readings were made in triplicate with each device and the average values compared. The order in which devices were used was random. Since the Vicorder includes an optional algorithm to adjust for the influence of the additional femoral segment on measured PWV, both unadjusted (Vicorder) and adjusted (Vicorder_adj) values were analysed.
Results: PWV ranged from 4.47m/s-14.60m/s (SphygmoCor), 3.70m/s-14.03m/s (XCEL), 4.40m/s-14.20m/s (Vicorder) and 3.60m/s-16.63m/s (Vicorder_adj). The XCEL and Vicorder PWV values were significantly correlated with SphygmoCor values (Figure 1). PWV measured with the XCEL was significantly lower than SphygmoCor-derived PWV (mean±SD of difference 0.42m±1.74m/s, P=0.03), whereas Vicorder (-0.21±1.88m/s) and Vicorder_adj (0.07±2.21m/s) were not significantly different from SphygmoCor, albeit with somewhat higher SDs.
Conclusion: Cuff-based devices provide reasonable estimates of PWV when directly compared with a widely used tonometric method. Use of the correction algorithm in the Vicorder device resulted in a closer estimate of the average PWV as measured with SphygmoCor, but a greater spread of values around the mean.

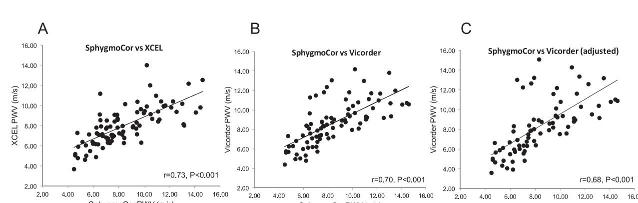

Figure 1 Correlation between SphygmoCor-derived PWV and XCEL (A), Vicorder (B) and Vicorder-adj (C) PWV values.