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P141: COMPARISON BETWEEN TECHNIQUES OF EVALUATION MICROVASCULAR MORPHOLOGY: THE GOLD-STANDARD LOCALLY INVASIVE MICROMYOGRAPHY VS. THREE NON-INVASIVE TECHNIQUES. PRELIMINARY DATA

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Conclusions: Despite the challenging ultrasound images of the fetal ascending aorta, local PWV measurement has proven to be possible through recordings of diameter and blood velocity. PWV increases with gestational age and it is higher in FGR than normal fetuses. Further studies are needed to determine the potential clinical predictive value of fetus PWV.

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COMPARISON OF EJECTION DURATIONS DERIVED FROM RADIAL AND BRACHIAL PRESSURE WAVES

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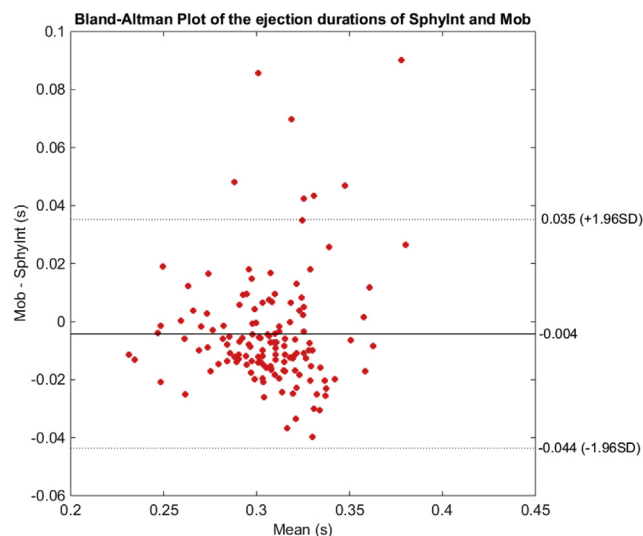
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Purpose: The ejection duration (ED) is an important indicator of ventricular function as well as ventriculo-arterial coupling. Thus, the non-invasive oscillometric determination of ED from arterial pressure waves could enhance methods of pulse wave analysis. The aim of this work was to test and to validate the calculation of ED based on measurements from two different devices (brachial oscillometry and radial tonometry).

Methods: 138 pulse wave measurements from 79 patients were obtained in direct succession with the Mobil-O-Graph (IEM, Germany) and with the Sphygmocor device (At Cor Medical Pty. Ltd., Australia) in a comparative study. An algorithm based on numerical derivatives was developed to determine the ejection duration from the arterial pulse wave. For both measurements, the ED was calculated and the ED from the internal algorithm of the Sphygmocor was obtained.

Results: The mean ED of the internal Sphygmocor algorithm (Sphylnt) is 309±27 ms, of the calculated ED from the Mobil-O-graph measurements (Mob) 304±29 ms and of the calculated ED from the Sphygmocor recordings (Sphy) 308±30 ms. So, the mean differences between Mob and Sphylnt are -4±20ms, see figure, and between Mob and Sphy are -3±26ms. The sampling rates of Sphygmocor and Mobil-O-Graph are 128 respectively 100 Hz, so the mean errors are below the particular step sizes.



Conclusion: The algorithm for calculation of the ED was tested successfully on radial and brachial recordings. As the differences between locations as well as between algorithms are sufficiently small, the determination of ejection duration from brachial oscillometric pulse waves seems feasible.

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COMPARISON OF DOPPLER AND OSCILLOMETRIC METHODS OF ASSESSING ANKLE-BRACHIAL INDEX IN PATIENTS WITH SYSTEMIC LUPUS ERYTHEMATOSUS

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Objective: Peripheral arterial disease (PAD) is a common cardiovascular complication in systemic lupus erythematosus (SLE) patients [1]. PAD is objectively diagnosed with ankle-brachial index (ABI), which can be measured by the Doppler method, or oscillometric technique [2]. In Ghanaian SLE patients, we compared the utility of oscillometric ABI to Doppler ABI, which is the 'gold standard'.

Method: ABI was measured using 8 MHz hand-held Doppler (LifeDop 250, Summit Doppler) and oscillometric technique (Vasera 1500N, Fukuda Denshi) in 80 SLE patients (160 legs). PAD was defined as ABI < 0.9 in at least one leg.

Results: There prevalence of PAD by oscillometric technique was higher than that of Doppler technique (32.5% vs 23.8%, $p = 0.004$). There was fair level of agreement between PAD by Doppler and oscillometric techniques ($\kappa = 0.36$, $p = 0.003$). Doppler ABI correlated with oscillometric ABI in the right leg ($r = 0.34$, $p = 0.005$), but not in the left leg ($r = 0.18$, $p = 0.127$). Reliability analysis showed that Doppler-ABI does not agree with oscillometric ABI in both right (intraclass $r = 0.23$, $p = 0.13$) and left (intraclass $r = 0.31$, $p = 0.061$) legs.

Conclusion: In Ghanaian SLE patients with high prevalence of PAD, measurement of ABI using oscillometric technique does not agree with Doppler-based ABI.

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COMPARISON BETWEEN TECHNIQUES OF EVALUATION MICROVASCULAR MORPHOLOGY: THE GOLD-STANDARD LOCALLY INVASIVE MICROMYOGRAPHY VS. THREE NON-INVASIVE TECHNIQUES. PRELIMINARY DATA

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Objective: The gold standard technique of evaluation microvascular morphology in human is generally considered the measure of media to lumen ratio (M/L) of subcutaneous small vessels obtained by local biopsies and evaluated by wire or pressure micromyography. However, non-invasive techniques for the evaluation of retinal arterioles were recently proposed, in particular two approaches seem to provide interesting information: Scanning Laser Doppler Flowmetry (SLDF) and adaptive optics (AO); both of them provide an estimation of the wall to lumen ratio (WLR) of retinal arterioles. A non-invasive measurement of basal and total capillary density may be obtained by videomicroscopy/capillaroscopy. No direct comparison of the non-invasive techniques in the same population was previously performed, in particular AO was never validated against micromyography.

Methods: In the present study, we enrolled 12 normotensive subjects and 8 hypertensive patients undergoing an election surgical intervention; (11/20 were severely obese). All patients underwent a biopsy of subcutaneous fat during surgery. Subcutaneous small resistance artery structure was assessed by wire myography and the M/L was calculated. WLR of retinal arterioles was obtained by SLDF and AO (SLDF, Heidelberg Engineering, Heidelberg, Germany and RTX-1, Imagine Eyes, Orsay, France). Functional (basal) and structural (total) microvascular density were evaluated by capillaroscopy before and after venous congestion.

Results: The results are summarized in the Table (slope of the relation: $p < 0.01$ RTX-1 vs. SLDF).

	Basal capillary density in the nailfold/M/L	Total capillary density in the forearm / ML	Basal capillary density in the dorsum of the finger / M/L	Total capillary density in the dorsum of the finger / ML
Correlation coefficients (n = 20)	0.53, $r^2 = 0.28$, $p < 0.05$	0.50, $r^2 = 0.25$, $p < 0.05$	0.17, $r^2 = 0.29$, $p = NS$	0.34, $r^2 = 0.12$, $p = NS$
	W/L retinal arterioles (SLDF) / M/L	W/L retinal arterioles (RTX-1) / M/L	W/L retinal arterioles (SLDF) / W/L retinal arterioles (RTX-1)	
Correlation coefficients (n = 20)	0.54, $r^2 = 0.29$, $p < 0.01$	0.90, $r^2 = 0.81$, $p < 0.001$	0.71, $r^2 = 0.50$, $p < 0.001$	

Conclusions: Our data suggest that AO has a substantial advantage over SLDF in terms of evaluation of microvascular morphology, since it is more closely correlated with the M/L of subcutaneous small arteries, considered a gold-standard approach.

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AORTIC ROOT STIFFNESS AND MECHANICAL PROPERTIES OF HEALTHY ADULTS

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Background: Arterial stiffness, often expressed in terms of pulse wave velocity (PWV), is an important risk factor for cardiovascular disease. PWV can be determined locally and non-invasively, by means of ultrasound.

Aim: To assess PWV, local compliance (Cs), distensibility (Ds) and Young's modulus of the aortic root using non-invasive ultrasound measurements.

Methods: 10 healthy volunteers aged 21–39, 1 male, were scanned using ultrasound (GE, Vivid E95) with a phased array transducer 1.5–4.5MHz. DICOM images were recorded from the parasternal long axis: M-mode for diameter measurements, and apical 5-chamber view for blood Doppler velocity, sequentially. Each measurement was repeated 3 times for 20s. Velocity and diameter waveforms were extracted offline in Matlab based on grey-scale thresholding. PWV was determined using the ln(D) U-loop method [1]. Wall thickness was extracted from the B-mode images used to measure the diameter. Distensibility and compliance were calculated as $Ds = 1/(\rho \cdot PWV^2)$, $Cs = dA/dP = Ds \cdot A$, where $\rho = 1050 \text{ kg/m}^3$ blood density, A is the cross-sectional area, and Young's modulus was calculated as previously described [2] using the Bramwell-Hill and Moens-Kortweg equations.).

Results: Across all patients mean PWV was $3 \pm 0.8 \text{ m/s}$, mean distensibility was $1.3 \cdot 10^{-4} \pm 0.61 \cdot 10^{-4} \text{ Pa}^{-1}$, and mean compliance was $0.6 \pm 0.31 \text{ m}^2 \text{ Pa}^{-1}$. The average wall thickness was $0.4 \pm 0.06 \text{ cm}$ while Young's modulus was $63.6 \pm 40.4 \text{ kPa}$. These results are comparable to corresponding values reported in the literature using other techniques.

Conclusions: Aortic root PWV, distensibility, compliance and Young's modulus can be determined using ultrasound measurements of diameter and velocity. Further studies are required to investigate the potential clinical utility of aortic root parameters.

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VALIDITY OF PULSE WAVE VELOCITY AND AUGMENTATION INDEX MEASUREMENTS IN PATIENTS WITH ATRIAL FIBRILLATION

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Background: Individualized weighing of the risk-benefit of anticoagulation is recommended in patients with atrial fibrillation (AF) that have low established risk scores or, conversely, are at increased risk for bleeding¹. Parameters of arterial stiffness and wave reflection could improve risk stratification, but their use has not been validated in arrhythmia²⁻³.

Methods: We measured carotid-femoral pulse wave velocity (PWV), central augmentation index (AI) and central pulse pressure (CPP) using the Sphygmocor (AtCor Medical, Sydney, Australia) system in 34 patients (53 to 85 years; 25 males) with AF before and after elective electrical cardioversion. Agreement was assessed using the intraclass correlation coefficient (ICC) and the coefficient of variation, completed with Bland-Altman plots.

Results: Following cardioversion, mean arterial blood pressure (MAP) and heart rate (HR) decreased significantly by 7 mmHg and 18 bpm respectively. PWV decreased from 11.8 m/s to 10.7 m/s, AI increased from 24% to 29%, and CPP rose from 45 mmHg to 50 mmHg. The decrease in PWV was related to the decrease in MAP ($\beta = 0.57$; $R^2 = 0.33$; $P < 0.001$) whereas changes in AI and CPP were related to the decrease in HR (AI: $\beta = -0.59$; $R^2 = 0.35$; $P < 0.001$, CPP: $\beta = -0.52$; $R^2 = 0.26$; $P = 0.001$).

After adjustment for changes in MAP and HR, reliability analysis showed an excellent agreement for PWV (ICC = 0.89; 95%CI: 0.79–0.95) but moderate agreement for AI (ICC = 0.59; 95%CI: 0.17–0.80). Excellent agreement was also found for CPP (ICC = 0.89; 95%CI: 0.78–0.94).

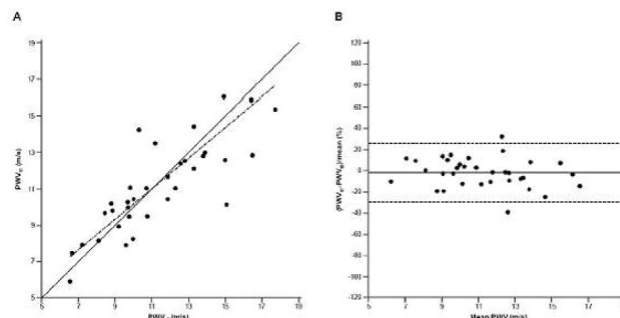


Figure 1. A. Scatter plot showing PWV before (PWV_{t0}) and after (PWV_{t1}) cardioversion. The solid line is the line of identity, the broken line the regression line for PWV_{t1} vs PWV_{t0} (Passini & Bablok regression). B. Bland-Altman plot showing the proportional difference (%) between PWV after (PWV_{t1}) and PWV before (PWV_{t0}) cardioversion. The solid line represents the mean value of PWV and the dotted lines mean ± 2 SD.