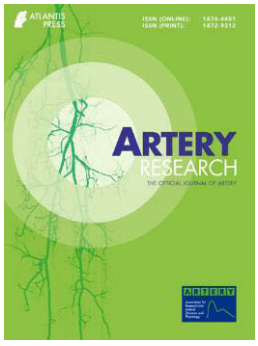

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P128: RADIAL INTIMA-MEDIA THICKNESS ASSESSMENT BY ULTRA-HIGH FREQUENCY ULTRASOUND AND AUTOMATED IMAGE-ANALYSIS IN HEALTHY VOLUNTEERS

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Variable	Mean	SD
Age, years	69.1	6.2
Male sex, n (%)	416	(78.9)
Systolic BP, mmHg	141.3	16.2
Diastolic BP, mmHg	84.9	10.4
MAP_{osc}, mmHg	100.7	10.6
MAP_{wave}, mmHg	105.3	11.6
Heart rate, min^{-1}	65.8	11
FF_{osc}	0.28	0.02
FF_{wave}	0.36	0.04
$MAP_{0.4}$, mmHg	107.5	

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Poster Session II — Models, Methodologies and Imaging Technology II

P126
THE ASSOCIATION OF THE INTEGRATED CENTRAL PRESSURE-STIFFNESS RISK SCORE WITH CARDIOVASCULAR MORTALITY IN HEMODIALYSIS PATIENTS

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Background: Our aim was to study the predictive power of ICPS risk categories on CV mortality in hemodialysis patients.
Methods: In our retrospective cohort study 91 patients were involved from two dialysis centers. Pulse Wave Velocity (PWV), central systolic blood pressure (cSBP) and and central pulse pressure (cPP) were measured with tonometric method, patients were followed for a median of 29.5 months and CV mortality was registered. Patients were classified into tertiles based on their PWV, cSBP and cPP values. After the analysis of the predictive values of the tertiles of the identical parameters, patients were scored. One score was given, when a patient had a third tertile value of cSBP or a second or third tertile value of PWV or cPP. Then the CV outcome was analyzed with Cox regression analysis of the groups of patients with different ICPS scores and three ICPS risk categories were defined: average (0-1 point), high (2 points) and very high (3 points).
Results: During follow-up 31 events occurred. After adjustment for multiple factors, compared with the average ICPS risk category group (n = 35; 38%), those, who were in the high risk group (n = 33; 30%) showed a tendency for significantly higher hazard ratio (HR) of CV mortality (HR = 2.62, 95% confidence interval (CI):0.82—8.43), while patients in the very high ICPS risk category (n = 23; 21%) had a markedly increased risk (HR = 10.03, CI:1.67—60.42).
Conclusions: The ICPS risk categories can help in the identification of hemodialysis patients with high CV risk.

P127
SPATIAL VARIATION OF RESERVOIR PRESSURE IN CHILDREN ASSESSED WITH HIGH FIDELITY PRESSURE MEASUREMENT IN FIVE AORTIC LOCATIONS

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Objective: To assess whether reservoir pressure (Pres) in young individuals with a compliant aorta is uniform throughout the aorta, as has recently been reported in older adults with cardiovascular disease (1).
Methods: High fidelity pressure was measured with a Verrata wire (Philips Volcano) in 5 aortic locations (ascending-to-abdominal) via pull-back in 11 children with a normal aorta (age 10.4 ± 4.9 years, mean ± SD). Pres was calculated using the 'pressure-only' approach (2), with exponential fitting over the whole of diastole (1) (WholeDia) or the period when pressure declined in an approximately exponential fashion (ExpDia).
Results: ExpDia produced a better fit than WholeDia ($R2 = 0.99 \pm 0.01$ vs 0.91 ± 0.11, $P < 0.001$). P_{res} amplitude (ΔP_{res}) in the ascending aorta from WholeDia fitting (12.0 ± 4.1 mmHg) was less than with ExpDia fitting (19.0 ± 5.2, P = 0.001). The zero-flow asymptotic pressure (P_{inf}) obtained from the fitting procedure was negative (non-physiological) in 76% (WholeDia) and 44% (ExpDia) of recordings, but fixing P_{inf} to 37 mmHg (average of physiological values) had little effect on the resulting ΔP_{res}. ΔP_{res} varied by 5.7 ± 3.0 mmHg (WholeDia) and 7.3 ± 3.7 mmHg (ExpDia) between aortic locations (both $P<0.001$ compared with zero), corresponding to 44% ± 30% and 38% ± 17% of average ΔP_{res} respectively. Maximum instantaneous spatial differences in P_{res} amounted to a substantial percentage of ΔP_{res} (45% ± 37% WholeDia; 24% ± 26% ExpDia) and were not reduced by time and/or pressure offsets to align P_{res} foot.
Conclusion: In young individuals, P_{res} was sensitive to the fitting period and often resulted in non-physiological P_{inf} values. Regardless of calculation method or alignment, P_{res} was not uniform along the aorta.

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P128
RADIAL INTIMA-MEDIA THICKNESS ASSESSMENT BY ULTRA-HIGH FREQUENCY ULTRASOUND AND AUTOMATED IMAGE-ANALYSIS IN HEALTHY VOLUNTEERS

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Background: Ultrahigh-frequency ultrasound may represent a powerful tool for investigating the arterial properties of medium and small-size arteries. Aim of this study was: 1) to evaluate intra- and inter-operator reproducibility of radial artery vascular parameters (intima-media thickness —IMT- and diastolic diameter -DD), obtained both with a manual and an automatic approach; 2) to identify physiological correlates of radial IMT.
Methods: 40 healthy subjects were examined by Vevo MD (FUJIFILM, VisualSonics, Toronto, Canada); in 11 volunteers two B-mode clips (longitudinal view) of the radial artery were acquired for each subject by two skilled operators. IMT DD were measured manually and using an automatic software (Cardiovascular Suite, QUIPU, Pisa, Italy). Coefficient of variations (CV) and Bland-Altman analysis were employed.

Results: The manual approach provided intra-operator CV of 6.6% and 3.9% for DD and 6.5% and 6.6% for IMT (first and second operator). The automatic approach provided CV equal to 6.6%, 5.4%, 4.5% and 3%, respectively. Inter-operator CV were 11.3% for DD and 3.9% for IMT (manual), and 10.9% and 5.8% (automatic). Bland-Altman analysis provided non-significant bias for both IMT and DD measurements comparing manual and automatic approach. In the whole population, radial IMT was correlated with age ($r = 0.35$, $p = 0.02$) and pulse pressure ($r = 0.41$, $p = 0.008$), not with BMI ($r = 0.05$, $p = 0.76$) and mean blood pressure ($r = 0.17$, $p = 0.28$). No sex differences were observed.
Conclusions: We obtained good CV values for both the intra- and inter-operator reproducibility; furthermore, the manual and the automatic approach provided similar results. Radial IMT increases with age and pulse pressure.

P129
DETERMINATION OF THE DIASTOLIC PRESSURE DECAY CONSTANT (TAU) FROM RADIAL TONOMETRY: DEMOGRAPHIC AND HEMODYNAMIC ASSOCIATIONS IN NORMAL AND HYPERTENSIVE INDIVIDUALS

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Introduction: The feasibility of measuring the diastolic pressure-decay constant (tau) in normal and hypertensive humans is not established and the clinical and physiological relevance of tau is not known.
Methods: Studies were performed in the non-invasive cardiac laboratory in subjects who had been supine for at least 30 minutes. Measurements included standard oscillometric cuff BP, echocardiography (stroke volume [SV] and systemic vascular resistance [SVR]), pulse wave velocity (PWV, both aortic [heart-femoral] and peripheral [femoral-ankle]), and radial tonometry (Sphygmocor). Tau was estimated by photo-digitizing the pulse contour (Webplot digitizer) and modeling the terminal diastolic component according to the formula: $P = A + (SBP-A)*\exp(-(t-t0)/tau)$, where P is pressure, A is the modeled diastolic BP, and t0 is the start of the mono-exponential diastolic pressure decay.
Results: Full data were available In 76 individuals (mean age 55 years, weight 84 kg, BP 138/79 mmHg, resting HR 67; 45% female). Using simple Pearson correlations, tau was positively correlated with age, female gender and SVR, but negatively correlated with HR (all $p < 0.05$). Tau was unrelated to blood pressure (systolic, diastolic, mean or pulse pressure) or to peripheral or central PWV. In a forward stepwise multiple regression model of tau that included various hemodynamic indicators, only SVR survived, whereas BP, HR, SV, and PWV were excluded.
Conclusions: Tau can be estimated from radial tonometry and is most closely related to SVR, age, and female gender. Further application of tau (e.g. in the study of circulatory models) also seems feasible.

P130
COMPARISON BETWEEN PWV MEASURED FROM CUTANEOUS LENGTH BY SPHYGMOCOR AND BY MRI LENGTH TRACED ALONG THE WHOLE AORTA

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Background: Accuracy of non-invasive PWV as m/sec is impeded by crude surface estimates of aortic length. We compared PWV measured using the Sphygmocor via surface length measurements with PWV measured using MRI with distance traced more precisely along the whole imaged aortic length.
Methods: Magnetic resonance imaging (MRI) was performed in 74 asymptomatic women aged between 51—80 years of age. Carotid-femoral PWV was measured using Sphygmocor. The path distance between the carotid and femoral sites was estimated from the distance between the sternal notch and femoral artery at the point of applanation. Phase-contrast MRI was performed at the level of the aortic arch and distal to the aortic bifurcation to obtain aortic flow. Aortic distance was measured by tracing the centre of the aorta from a black-blood MRI sequence.
Results: Mean (±SD) carotid-femoral transit time (TT) measured by Sphygmocor (58 ± 11 ms) was 2.9 [95% confidence interval (CI) 0.85—5.0]ms higher than aortic TT measured by MRI (54 ± 12 ms). The carotid-femoral surface distance estimate (552 ± 33 mm) was 15 [142—162]mm higher than the aortic length estimate (399 ± 32 mm). Corresponding PWVs estimated with Sphygmocor and MRI were 9.87 ± 2.1 and 7.63 ± 1.9 ($P < 0.001$) m/s, respectively. PWV differences between Sphygmocor and MRI decreased to 0.50 (0.13—0.86)m/s when Sphygmocor PWV was calculated using the MRI path length.
Conclusion: In these older women, the PWV difference between Sphygmocor and MRI is reduced when MRI length estimates are used. The difference between PWV measured by Sphygmocor and MRI is in part due to the accuracy of distance measurements.

P131
UTERINE ARTERIES EVALUATION DURING PREGNANCY: MODELING AND COMPUTATIONAL FLUID DYNAMICS CALCULATIONS

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Preeclampsia (PE) affects pregnancy, being one of the main causes of prenatal maternal mortality and morbidity (1). Recent studies show that PE is characterized by a significant reduction on maternal cardiac output and increased peripheral resistance. However, studies on the maternal hemodynamic adaptation during PE and the available information about central maternal hemodynamics are scarce. Our purpose is to develop a computational model to obtain relevant hemodynamic parameters of the maternal circulation, formed by the common iliac (CI), the internal (II) and the external iliac (EI) and the uterine arteries (UA). Model construction requires many approximations and generalizations to optimize numerical calculation of hemodynamic parameters by Computational Fluid Dynamics (CFD), however this is the best representation of maternal circulatory system. Four different models were created to simulate non-pregnant women and 21, 30 and 36 weeks of pregnancy (2). Numerical simulations performed by ANSYS®-Fluent software correlate blood flow, velocity and arterial pressure, with the variation of uterine morphological data. Calculated flow values on CI and UA to different geometries represent the evolution of arterial system during pregnancy. As the UA suffers higher geometrical transformations during pregnancy, there are a greater increase on blood velocity; blood velocity on the EI increases, remaining almost constant in the CI arteries.The growth on blood flow due to pregnancy development is associated to an augmentation on the arteries' diameter, which allows the maintenance of blood pressure on UA.This model is suitable to compare wall shear, velocity or flow values associated to PE, measured in clinical context.

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P132
CONTINUOUS MEASUREMENTS OF CENTRAL BLOOD PRESSURE DURING MENTAL STRESS MONITORING

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