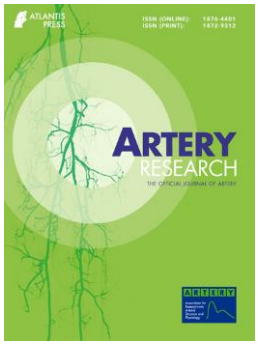

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3.5: NON-INVASIVE US-BASED WAVE INTENSITY ANALYSIS IN MICE

Nicole Di Lascio, Claudia Kusmic, Francesco Stea, Francesca Lenzarini, Francesco Faita

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flow velocity measurements in the pulmonary artery. WIA was applied to the acquired data (1).
Results: In controls (n = 10), the wave speed in the pulmonary artery was 3.03 m/s (2.69 − 3.91 m/s) and this increased in pulmonary arterial hypertension (PAH, n = 11, 11.9 m/s [10.5 − 16.4 m/s]) and chronic thromboembolic pulmonary hypertension patients (CTEPH, n = 10, 15.1 m/s [11.5 − 16.8 m/s]). Wave intensity was significantly greater in PH patients compared to controls. Wave reflection index (WRI) was 3.81 % (3.58 − 6.24 %) in controls, 23.4 % (17.5 − 29.7 %) in PAH and 30.4 % (11.9 − 35.6 %) in CTEPH patients. WRI was not related to pulmonary vascular resistance or right ventricular fractional area change and patients with mildly and severely elevated pulmonary pressure had similar WRI.
Conclusions: Wave speed, wave intensity and wave reflection in the pulmonary artery was higher in PH patients indicating increased arterial stiffness, right ventricular work and vascular impedance mismatch, respectively. While WRI does not reflect the severity of PH in established disease, the presence of increased wave reflection could be a novel early marker of pulmonary vascular disease.
References
1. Parker, K. H.: An introduction to wave intensity analysis. Med Biol Eng Comput, 47: 175, 2009.

3.5
NON-INVASIVE US-BASED WAVE INTENSITY ANALYSIS IN MICE

Dr Nicole Di Lascio [1], Dr Claudia Kusmic [2], Dr Francesco Stea [3], Dr Francesca Lenzarini [2], Dr Francesco Faita [2]
[1]*Institute of Life Science, Scuola Superiore Sant'Anna, Pisa, Italy*
[2]*Institute of Clinical Physiology, National Research Council, Pisa, Italy*
[3]*Department of Clinical and Experimental Medicine, University of Pisa, Italy*

Wave Intensity Analysis (WIA) can provide information about the interaction between vascular and cardiac system. WIA-derived indexes have quantitative physiological meaning. We investigated age-associated changes in WIA-derived parameters in mice and correlated them with biomarkers of cardiac function.
Sixteen wild-type male mice (strain C57BL6) were imaged with high-resolution ultrasound (Vevo 2100) at 8 weeks (T0) and 25 weeks (T1) of age. Carotid pulse wave velocity (PWV) was calculated from B-Mode and PW-Doppler images using the lnD-V loop and employed to evaluate WIA: amplitudes of the first (W1) and the second (W2) local maxima and minimum (Wb) were assessed. Reflection index (RI) was assessed as Wb/W1. Cardiac output (CO), ejection fraction (EF) fractional shortening (FS) and stroke volume (SV) were evaluated strain analysis provided strain and strain rate values for longitudinal, radial and circumferential directions (LS, LSR, RS, RSR, CS, CSR). Isovolumetric relaxation time (IVRT) was calculated from mitral inflow PW-Doppler images and normalized for cardiac cycle length.
W1(T0:4.42e-07±2.32e-07m2/s T1:2.21e-07±9.77e-08m2/s), W2(T0:2.45e-08±9.63e-09m2/s T1:1.78e-08±7.82e-09m2/s), Wb(T0:-8.75e-08±5.45e-08m2/sT1:-4.28e-08±2.22e-08m2/s), CO(T0:19.27±4.33ml/min T1:16.71±2.88ml/min), LS(T0:17.55±3.67% T1:15.05±2.89%), LSR(T0:6.02±1.39s-1 T1:5.02±1.25s-1), CS(T0:27.5±5.18% T1:22.66±3.09%) and CSR(T0:10.03±2.55s-1 T1:7.50±1.84s1) significantly reduced with age. W1 was significantly correlated with CO(R=0.58), EF(R=0.72), LS(R=0.65), LSR(R=0.89), CS(R=0.61), CSR(R=0.70) at T0; correlations were not significant at T1.!
The decrease in W1 and W2 suggests a reduction in cardiac performance, while that in Wb, in view of unchanged RI, can be associated with a reduction in the total energy carried by the wave. The loss of correlation between WIA-derived parameters and cardiac biomarkers might reflect an age-associated alteration in cardio-vascular coupling.

3.6
LONGITUDINAL CHANGES IN AORTIC RESERVOIR FUNCTION INDEPENDENTLY PREDICT DECLINING RENAL FUNCTION AMONG HEALTHY INDIVIDUALS

Dr Rachel Climie, Mr Dean Picone, Dr James Sharman
Menzies Institute for Medical Research, Hobart, Australia

Objectives: Aortic reservoir function independently predicts end organ damage in cross sectional analyses. However, longitudinal associations are more important regarding causation, but this has never been examined and was the goal of this study.
Methods: Aortic reservoir function (excess pressure integral [xsP] and aortic reservoir pressure), aortic stiffness, brachial and central blood pressure (BP), and renal function (estimated glomerular filtration rate [eGFR]) were recorded among 33 healthy individuals (57±9 years 55% male) at baseline and after an average 3.0±0.3 years.
Results: Over the follow up period there was no significant change in brachial BP ($p>0.05$), whereas there was a trend for xsP ($p=0.061$) and central BP ($p=0.068$) to increase. On the other hand, aortic stiffness and blood glucose increased significantly ($p<0.05$ both). The change over time in xsP (but not aortic stiffness) was significantly related to the change in eGFR ($r=-0.370$, $p=0.044$) and this remained independent age, 24 hour systolic BP and body mass index ($\beta=-0.031$, $p=0.045$), but not blood glucose ($\beta=-0.031$, $p=0.053$). There was no interaction between the change in glucose and change in xsP.
Conclusions: Aortic reservoir function, as determined by excess pressure, is independently associated with a decline in renal function among healthy people followed over 3 years. These novel findings indicate the need to determine the underlying physiological determinants of aortic reservoir function.

3.7
ARTERIAL STIFFNESS FOR THE EARLY PREDICTION OF PRE-ECLAMPSIA COMPARED WITH CLINICAL CHARACTERISTICS, UTERINE ARTERY DOPPLER INDICES, AND ANGIOGENIC BIOMARKERS

Ms Kim Phan, Ms Yessica Haydee Gomez, Ms Jessica Gorgui, Dr Amira El-Messidi, Dr Robert Gagnon, Dr Stella Daskalopoulou
McGill University, Montreal, Canada

Objective: To develop a model for the 1st trimester prediction of pre-eclampsia.
Methods: In this prospective longitudinal study, women with high-risk singleton pregnancies were recruited and arterial stiffness was measured using applanation tonometry (SphygmoCor, AtCor) and compared between women who developed PE and those who had a normotensive pregnancy. Arterial stiffness and hemodynamics were assessed, in the 1st trimester, every 4 weeks thereafter, and at 6 weeks postpartum. Angiogenic biomarker concentrations (Quantikine, R&D Systems) were measured at each trimester and at 6 weeks postpartum, and a bilateral uterine artery Doppler (UAD) was performed in the 2nd trimester.
Results: Of the 155 women recruited, 13 developed pre-eclampsia. Analyses adjusted for both maternal age and body mass index showed women who developed pre-eclampsia had significantly increased wave reflection and carotid-femoral pulse wave velocity (cfPWV) from the 1st trimester, throughout pregnancy, and at 6 weeks post-partum with a cfPWV:carotid-radial PWV mistmatch seen in the 1st and 3rd trimester (all p-values<0.05). Arterial stiffness (AUC: 0.80) was a better predictive tool than angiogenic biomarkers (AUC: 0.60; $p=0.04$) or UAD (AUC: 0.53; $p<0.001$) and improved detection of pre-eclampsia when combined with all other predictions (AS sensitivity: 79.8% vs other combinations' sensitivity: 69.2%).
Conclusions: Arterial stiffness and wave reflection is higher in the 1st trimester, throughout pregnancy, and does not resolve 6 weeks after pregnancy in women who develop pre-eclampsia. It also had superior preeclampsia predictive value over angiogenic biomarkers and UAD alone and improved detection rates when combined with all predictors including clinical characteristics.

3.8
CAN ARTERIAL WAVE AUGMENTATION IN YOUNG ADULTS EXPLAIN VARIABILITY OF CARDIOVASCULAR RISK IN ETHNIC MINORITIES?

Dr Luca Faconti [1,2,3]
[1]*Cardiovascular and Social Epidemiology Groups, Diabetes and Nutritional Sciences Division, King's College, London, UK*
[2]*Social and Public Health Sciences Unit, University of Glasgow, UK*
[3]*Institute for Applied Health Research, Glasgow Caledonian University, Glasgow, UK*

Objective: Traditional cardiovascular (CV) risk factors do not fully explain ethnic differences in CV disease [1,2]. We tested if pulse wave velocity