



King's Research Portal

[Link to publication record in King's Research Portal](#)

Citation for published version (APA):

Faconti, L., McNally, R. J., Farukh, B., & Chowienczyk, P. J. (2019). DISASSOCIATION OF PULSE WAVE VELOCITY WITH BLOOD PRESSURE DURING DEVICE GUIDED BREATHING. *Journal of Hypertension*, 37.

Citing this paper

Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

General rights

Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the Research Portal

Take down policy

If you believe that this document breaches copyright please contact librarypure@kcl.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

⁶Institute of Cardiology, Department of Congenital Heart Disease, Warsaw, POLAND, ⁷Institute of Cardiology, Department of Interventional Cardiology and Angiology, Warsaw, POLAND, ⁸Medical University of Warsaw, Department of General, Vascular and Transplant Surgery, Warsaw, POLAND, ⁹Medical University of Warsaw, Department of General, Transplant and Hepatic Surgery, Warsaw, POLAND, ¹⁰Université Catholique de Louvain, Pole of Cardiovascular Research, Institut de recherche expérimentale et clinique, Brussels, BELGIUM

Objective: Visceral artery fibromuscular dysplasia (VA FMD) is being rarely reported, with clinical picture ranging from asymptomatic to life-threatening. The aim of the study is to evaluate the prevalence and clinical characteristics of VA FMD.

Design and method: Out of 330 patients enrolled into ongoing ARCADIA-POL study since January 2015 (instituted as Polish-French collaboration) we present 225 patients (185 females, mean age: 46.1 ± 14.7 ys) with confirmed FMD in at least one vascular bed. All patients underwent detailed clinical evaluation including ABPM, biochemical evaluation, bio-banking, duplex Doppler of carotid and abdominal arteries and whole body angio-CT. In the current analysis, we focused on the prevalence and clinical characteristics of VA FMD (defined as the presence of typical FMD lesions in superior or inferior mesenteric arteries, as well as celiac trunk, splenic and hepatic arteries).

Results: Visceral FMD was present in 32 patients (19.1%). Among them, 75% (n = 24) were females, the mean age was 48.6 ± 17.2 years and 96.9% of patients have multivessel FMD. 28 patients reported FMD lesions in mesenteric arteries or celiac trunk, 6 patients in splenic and 8 patients in other visceral arteries. In 28 (12.4%) patients, aneurysms were found in visceral arteries, most commonly in splenic arteries (23 pts [10.2%]). In 2 patients, aneurysms were present in more than one visceral artery. In one patient, a dissection of the celiac trunk was identified. Patients with VA FMD most commonly reported abdominal pain (10 patients, 31.2%). 5 (15.6%) patients suffered from weight loss and 6 (18.6%) from postprandial abdominal pain. 3 patients with VA FMD experienced emergencies. Two patients underwent intestine resection due to acute mesenteric ischemia caused by occlusion of the upper mesenteric artery and of the celiac trunk respectively. In a third patient, the primary manifestation of VA FMD was rupture of hepatic aneurysm complicated by hypovolemic shock. The aneurysm was eventually embolized, with favorable clinical outcome.

Conclusions: In ARCADIA-POL study, VAFMD was present in every fifth patient. The clinical presentations of VA FMD varied from asymptomatic lesions to emergencies, including critical ischemia and life-threatening aneurysm bleeding. Our results support screening for VA FMD in patients with FMD in other vascular beds.

IN-VITRO CHARACTERIZATION OF MOUSE CAROTID ARTERY MECHANICS BY DYNAMIC BIAxIAL PRESSURE-MYOGRAPHY

M. van der Bruggen¹, K. Reesink¹, P. Spronck¹, N. Bitsch¹, J. Hameleers¹, R. Megens², C. Schalkwijk¹, T. Delhaas¹, B. Spronck³. ¹CARIM/MUMC+, Maastricht, The Netherlands, ²Ludwig-Maximilians-Universität, Muenchen, Germany, ³Yale University, New Haven, CT, USA

Objective: Although in-vitro biomechanical behaviour of arteries is commonly studied under quasi-static conditions, dynamic (pulsatile, in-vivo) behaviour may differ substantially. We developed a set-up to characterize mouse carotid artery biaxial mechanics under quasi-static and dynamic conditions, using high-frequency ultrasound to track diameter and two-photon laser scanning microscopy (TPLSM) to capture the microstructure. We aimed to (1) quantify reproducibility and (2) compare quasi-static and dynamic elastic behaviour.

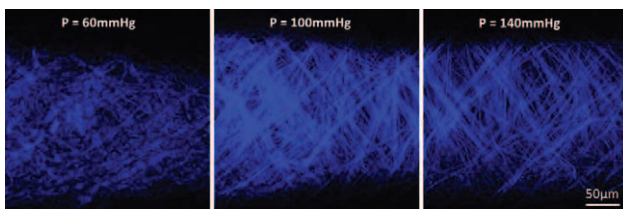


Figure. Adventitial collagen-structure deformation by second-harmonic generation TPLSM.

Design and method: After euthanasia, eight carotid arteries from four male surplus mice were mounted between glass micropipettes. Four carotids were tested directly after euthanasia, four on the day thereafter. Pressure (P) was recorded at the distal pipette; axial force (F) was recorded by a load cell. First,

arteries were stretched to in-vivo length and exposed to quasi-static pressure inflation from 0–200 mmHg. Second, axial stretch (Iz) was varied for constant pressures of 60/100/140 mmHg to determine an axial stiffness coefficient. Third, vessels were exposed to pulsatile pressures (systolic pressures of 80/120/160 mmHg, at 5 Hz) and at frequencies (f) of 2.5/5/10 Hz at 120 mmHg. Single-point pulse wave velocity (PWV; Bramwell-Hill) was determined and compared with corresponding PWVs calculated from the quasi-static pressure-diameter curve. The axial stiffness coefficient was obtained as the local slope of the F-Iz curve. Fourth, information on adventitial collagen-structure deformation was obtained using second-harmonic generation TPLSM. The first three protocol steps were performed in duplicate to determine coefficients of variation (CVs).

Results: CVs for PWV were ~9% for low/medium and 27% for high pressure. For f2.5 and f10 Hz these were 16% and 26%. Dynamic PWVs were higher than quasi-static PWVs for all test conditions ($p < 0.012$; mean \pm SD, at f5 Hz: PWVP80 2.4 ± 0.2 vs. 2.1 ± 0.1 m/s, PWVP120 6.3 ± 0.6 vs. 5.0 ± 0.5 m/s, PWVP160 13.3 ± 1.9 vs. 10.3 ± 2.2 m/s, and at P120 mmHg: PWVf2.5 3.9 ± 0.7 vs. 3.5 ± 0.3 m/s, PWVf10 3.1 ± 0.9 vs. 2.5 ± 0.2 m/s). Axial stiffness coefficients increased with pressure 60–140 mmHg (1.3 ± 0.4 , 2.4 ± 1.0 , 4.9 ± 2.8 grams). Measurements from fresh and non-fresh vessels were not significantly different ($p > 0.099$). From 60–100 mmHg undulation of adventitial collagen strands disappeared, whereas from 100–140 mmHg orientation changed (Figure).

Conclusions: Our innovative set-up shows well-acceptable reproducibility and demonstrates the importance of quasi-static and dynamic conditions when studying arterial mechanics.

THE RELATIONSHIP BETWEEN DIALYSIS MODALITY, ARTERIOVENOUS FISTULA AND HEMODYNAMIC PARAMETERS OF ARTERIAL RESERVOIR-WAVE ANALYSIS

M. Paré¹, C. Fortier¹, F. Mac-Way¹, M. Allard¹, K. Marquis¹, M. Schultz², J. Sharman², M. Agharazii¹. ¹CHU de Québec Research Center, L'Hôtel-Dieu de Québec, Dept. of Medicine, Laval University, Quebec, Canada, ²Menzies Institute for Medical Research, Hobart, AUSTRALIA

Objective: Arterial reservoir-wave analysis (RWA) is a new model of arterial hemodynamics that separates the arterial wave into reservoir pressure (RP) and excess pressure (XSP). Whether RWA parameters are different in hemodialysis (HD), as compared to peritoneal dialysis (PD), and whether any differences are due to the presence of an arteriovenous fistula (AVF) remains unknown. The aims of the present study were to examine the differences in RWA 1) in HD versus PD patients and 2) in all dialysis patients (HD+PD) without AVF versus HD patients with AVF.

Design and method: In a cross-sectional analysis of prevalent PD (n = 53) and HD (n = 208) patients, RWA was performed using pressure approach applied to the carotid pressure, which was calibrated with mean arterial pressure and used as a surrogate for central pressure. Among HD patients, 115 patients used AVF as vascular access.

Results: In HD patients, diastolic blood pressure (BP) was lower (69 ± 14 vs 77 ± 10 , mmHg, $p < 0.001$), while systolic BP was identical, resulting in increased carotid pulse pressure (PP) (58 ± 22 vs 50 ± 22 mmHg, $p = 0.036$). Carotid RP and XSP integrals were higher in HD patients (2.11 ± 0.91 vs 1.89 ± 0.94 , $p = 0.027$; 0.48 ± 0.30 vs 0.39 ± 0.27 , $p = 0.009$). While there were no significant differences in BP medication between groups. HD patients were older and had a higher prevalence of clinical comorbidities such as diabetes and established cardiovascular disease. However, analysis of data according to AVF status resulted in homogenous groups in terms of age and comorbidities. In AVF group, dialysis vintage was higher (median 2.3 vs 1.1 years, $p < 0.001$), diastolic BP lower (68 ± 13 vs 72 ± 13 mmHg, $p = 0.003$), PP higher (59 ± 22 vs 54 ± 22 , $p = 0.061$), and RP and XSP integrals were higher (2.2 ± 0.9 vs 2.0 ± 0.9 , $p = 0.048$; 0.5 ± 0.3 vs 0.4 ± 0.3 , $p = 0.078$). After adjustment for dialysis vintage, XSP was significantly higher in AVF group ($p = 0.034$).

Conclusions: In HD patients, RP and XSP integral were higher as compared to PD patients, but these differences were mainly due to the presence of AVF.

DISSOCIATION OF PULSE WAVE VELOCITY WITH BLOOD PRESSURE DURING DEVICE GUIDED BREATHING

L. Faconti, B. Farukh, R. McNally, P. Chowiecnyk. King's College London British Heart Foundation, Department of Clinical Pharmacology, St Thomas Hospital, London, UNITED KINGDOM

Objective: Arterial stiffness (AS) measured as carotid-femoral pulse wave velocity (cfPWV) is an important determinant of cardiovascular risk closely related to

brachial blood pressure (BP). Whether it can be changed independently of BP in the short term is uncertain but recent observations suggest that AS may be specifically modulated by the autonomic nervous system (ANS). Here we compared effects of device guided breathing (DGB, known to reduce sympathetic activity) with nifedipine on cfPWV.

Design and method: Patients with essential HT on pharmacological treatment (mean \pm SD age 48 ± 14 years, $n = 19$) had cfPWV (SphygmoCor) and brachial BP (Omron) measurements performed before and after DGB and oral administration of nifedipine 10 mg. The two interventions were performed consecutively in single visit with the patient lying in supine position. DGB is a biofeedback technique which slows the breathing rate to <10 breaths/minute and decreases BP via its action on the ANS. Nifedipine is a short acting peripheral arterial vasodilator that tends to increase sympathetic activity.

Results: Baseline systolic BP (SBP) 150.4 ± 12.6 and diastolic BP (DBP) 89.8 ± 8.7 mmHg, heart rate (HR) 65.9 ± 11.2 bpm; cfPWV 10.3 ± 2.4 m/s. Compared to nifedipine, DGB caused less reduction of both brachial SBP and DBP: decrease of 12.3 (95%CI 8.4, 16.1) vs. 16.1 (12.7, 19.5) mmHg in SBP for DGB and nifedipine and 5.9 (3.1, 8.7) vs. 10.4 (7.1, 13.5) mmHg in DBP ($P < 0.05$ for difference between DGB and nifedipine). DGB caused a greater reduction in cfPWV: decrease of 1.2 (0.8, 1.8) and 0.7 (0.1, 1.3) m/s for DGB and nifedipine respectively ($P = 0.02$ for difference between DGB and nifedipine). HR decreased during DGB by 3.6 (1.2, 5.9) bpm and increased after administration of nifedipine: 7.6 (3.9, 11.3) bpm.

Conclusions: DGB had a greater impact on AS despite a smaller effect on BP. These results demonstrate that cfPWV can be changed independently from BP in the short-term and support a specific role of the ANS in regulating cfPWV.