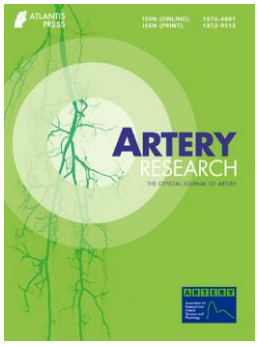

Artery Research

ISSN (Online): 1876-4401 **ISSN (Print): 1872-9312**
Journal Home Page: https://www.atlantis-press.com/journals/artres

8.7: CHANGES IN CARDIAC FUNCTION BUT NOT STRUCTURE IN HEALTHY SUBJECTS WITH PREMATURE VASCULAR AGEING

Oscar Mac Ananey, Vincent Maher

To cite this article: Oscar Mac Ananey, Vincent Maher (2016) 8.7: CHANGES IN CARDIAC FUNCTION BUT NOT STRUCTURE IN HEALTHY SUBJECTS WITH PREMATURE VASCULAR AGEING, Artery Research 16:C, 66–67, DOI: https://doi.org/10.1016/j.artres.2016.10.063

To link to this article: https://doi.org/10.1016/j.artres.2016.10.063

Published online: 7 December 2019

8.5
HEMODYNAMICS DURING INTRA- AND INTERDIALYTIC PERIODS DEPEND ON ULTRAFILTRATION VOLUME

Christopher Mayer [1], Stephan Geilert [2], Julia Matschkal [2], Uwe Heemann [2], Marcus Baumann [2], Christoph Schmaderer [2]
[1]*AIT Austrian Institute of Technology GmbH, Vienna, Austria*
[2]*Technical University of Munich, Germany*

Introduction: Parameters of arterial stiffness are independent cardiovascular risk factors for end-stage renal disease patients. Significant changes of these parameters between intra- and interdialytic periods have been reported previously [1]. The aim of this cross-sectional study is to describe the influence of the ultrafiltration volume on hemodynamic parameters.
Methods: All measurements were obtained with the Mobil-O-Graph 24h PWA (I.E.M. GmbH, Germany) within the ISAR hemodialysis study. Measurement started before the midweek dialysis session and lasted for 24-hours. 348 patients (238 male / 110 female 65 +- 18 years) were included. Intra- and interdialytic parameters were averaged and compared for three subgroups (ultrafiltration volume (UFV) $<=$ 500 ml (N = 50) 500 $<$ UFV$<=$ 2000 ml (N = 159) UFV $>$ 2000 ml (N = 139)) and all subjects.
Results: The results for all patients support the findings of Karpetas et al. [1] (see Table). Beyond [1], the results underpin the differences between subgroups for intra- and interdialytic periods. Furthermore, there are significant differences between intra- and interdialytic periods depending on the ultrafiltration volume (see Table). Exemplarily, there is a significant rise in the augmentation index (26.0 vs. 28.5%, $p < 0.05$) for UFV $>$ 2000 ml and for central pulse pressure (39.6 vs. 43.4 mmHg and 36.0 vs. 38.3, $p < 0.05$) for UFV $<=$ 2000 ml opposed to non-significance for the other subgroups.
Conclusions: Our findings support the hypothesis that hemodynamic parameters depend on ultrafiltration volume. Further studies should investigate their prognostic value considering the ultrafiltration volume.

	UFV $<=$ 500 ml			500 $<$ UFV $<=$ 2000 ml			UFV $>$ 2000 ml			All		
	In		Out	In		Out	In		Out	In		Out
pSBP (mmHg)	128.9		131.0	123.7		122.3	124.5		123.0	124.8		123.8
pDBP (mmHg)	75.9		74.5	74.9		72.3	75.6		73.1	75.3	*	72.9
pPP (mmHg)	53.0		56.5	48.8		50.0	478.8		49.9	49.4		50.9
HR (bpm)	69.4		70.2	68.1	*	70.8	71.8		73.7	69.8	*	71.9
cSBP (mmHg)	116.9		119.3	112.4		111.9	113.4		112.6	113.4		113.2
cDBP (mmHg)	77.3		75.9	76.3		73.6	77.2		74.6	76.8	*	74.3
cPP (mmHg)	39.6	*	43.4	36.0	*	38.3	36.2		38.0	36.6	**	38.9
AIx (%)	29.7		31.8	29.5		30.2	26.0	*	28.5	28.1	*	29.8
AIx75 (%)	26.4		28.8	25.5	*	27.7	24.0	**	27.6	25.1	**	27.8
PWV (m/s)	10.03		10.14	9.88		9.85	9.08		9.07	9.58		9.58

Table: Averaged hemodynamic parameters for intra- and interdialytic periods (In vs. Out) for different subgroups based on ultrafiltration volume (UF) and all subjects. Abbreviations: peripheral diastolic blood pressure (pDBP), peripheral systolic blood pressure (pSBP), peripheral pulse pressure (pPP), heart rate (HR), central diastolic blood pressure (cDBP), central systolic blood pressure (cSBP), peripheral pulse pressure (pPP), augmentation index (AIx, AIx75) and pulse wave velocity (PWV) */** marks a significant difference between intra- and interdialytic periods ($p < 0.05$ and $p < 0.01$, respectively).

References

1. Karpetas A, Sarafidis PA, Georgianos, PI, Protogerou A, Vakianis P, Koutroumpas G, Raptis V, Stamatiadis DN, Syrganis C, Liakopoulos V, Efstratiadis G, Lasaridis, AN. Ambulatory Recording of Wave Reflections and Arterial Stiffness during Intra- and Interdialytic Periods in Patients Treated with Dialysis. Clin J Am Soc Nephro. 2015 10(4):630-638.

8.6
AEROBIC FITNESS LEVEL AND PERIPHERAL ARTERIAL COMPLIANCE — THE ROLE OF AUTONOMIC NERVOUS SYSTEM TONE

Nejka Potocnik, Ziva Melik, Ksenija Cankar, Martin Strucl
Medical Faculty, Institute of Physiology, University of Ljubljana, Slovenia

Physical activity has beneficial effects on prevention of cardiovascular disease. Aerobic fitness is associated with higher central arterial compliance, but its effect on peripheral arterial compliance (pC) is controversial. We aimed to test the hypotheses that aerobic training augments pC at rest and during different autonomic nervous system provocations (ANSP) inyoung healthy men.
We enrolled 44 males, 19-24 years old (22 trained, VO2max=485ml/kg/min — group A, 22 sedentary controls, VO2max=303ml/kg/min — group B). VO2max was determined using cycloergometry (QuarkCPET, Cosmed). On the testing day, ECG, arterial blood pressure (Finapres, Ohmeda) and finger artery compliance at rest, 3 minutes during 0.1Hz breathing and 3 min during mental stress were measured. A noninvasive method was used to determine compliance index (CI), calculated as an average of the pressure dependant compliance curve in the range of arterial pressures from 97 to 105mmHg.
Our results revealed elevated CI in group A compared to group B (4.18±0.38 and 1.28±0.25, p=0.004) at rest and no significant differences in CI between groups during ANSP (1.34±0.20 at 0.1Hz breathing and 0.82±0.18 during mental stress in group A compared to 1.09±0.21, p=0.06, and 0.60±0.12, p=0.08 in group B). A statistically significant positive linear correlation existed between CI and VO2max ($P<0.001$) at rest in group A, however, no correlation was found at both ANSP.
Regular aerobic training increases pC in healthy young subjects at rest, but not during 0.1Hz breathing or mental stress. Our findings indicate that peripheral and not central autonomic mechanisms govern pC in young healthy males.

References

Terenzi TJ. An alteration in arterial compliance associated with elevated aerobic fitness.J Manipulative Physiol Ther. 2000 Jan23(1):27-31.
Ashor AW, Lara J, Siervo M, Celis-Morales C, Mathers JC. Effects of exercise modalities on arterial stiffness and wave reflection: a systematic review and meta-analysis of randomized controlled trials. PLoS One. 2014 Oct 159(10).
Boutouyrie P, Lacolley P, Girerd X, Beck L, Safar M, Laurent S. Sympathetic activation decreases medium-sized arterial compliance in humans. Am J Physiol. 1994 Oct267(4 Pt 2):H1368-76.

8.7
CHANGES IN CARDIAC FUNCTION BUT NOT STRUCTURE IN HEALTHY SUBJECTS WITH PREMATURE VASCULAR AGEING

Oscar Mac Ananey [1], Vincent Maher [2]
[1]*School of Biological Science, Dublin Institute of Technology, Dublin, Ireland*
[2]*Department of Cardiology, Tallaght Hospital, Dublin, Ireland*

Purpose: Changes in myocardial and arterial wall properties/function are consistently reported in patients with established cardiovascular disease[1]. However, few studies have reported these changes in early subclinical disease. The aim of the present study was to examine cardiac and vascular changes in early subclinical disease and to determine whether these changes occur in parallel.
Methods: For this study, 98 healthy lifelong never smokers were recruited. Subjects were categorised as having normal (Norm, n=71) or abnormal (High. n=27) arterial stiffness (carotid-femoral pulse wave velocity, PWV Vicorder, Skidmore, UK) for their age and blood pressure. M-mode Doppler echocardiography (Vivid 7 Dimension, GE, USA) was used to assess heart structure (interventricular septal thickness, IVSd left ventricular internal diameter, LVIDd left ventricular posterior wall thickness, LVPW left ventricular mass, LV Mass) and function (left ventricular isovolumetric relaxation time, LV IVRT mitral valve early/late filling velocity, MV E/A).

Results: No differences in age (39+/-9 v 39+/-9 years P 0.87) or BMI (24.85+/-3.29 v 25.75+/-3.68 kg.m^2 P 0.24) were observed. No differences in IVSd (0.86+/-0.15 v 0.85+/-0.18 cm P 0.64), LVIDd (4.98+/-0.55 v 4.96+/-0.42 cm P 0.95), LVPWd (0.81+/-0.17 v 0.90+/-0.21 cm P 0.05) or LV Mass (168.86+/-56.85 v 182.61+/-61.70 g P 0.43) were observed. However, MV E/A (1.85+/-0.51 v 1.48+/-0.51 P 0.0004), but not LV IVRT (0.09+/-0.02 v 0.09+/-0.01 P 0.25), was different.
Conclusions: Changes in cardiac function are observed before alterations in cardiac structure in healthy subjects with premature vascular stiffening.
References
1. Mansour AS, YannoutsosA, MajahalmeN, AgnolettiD, Safar ME, OuerdaneS, BlacherJ. Aortic stiffness and cardiovascular risk in type 2 diabetes. JHypertens. 2013; 31(8):1584-92.

8.8
SYMPATHETIC VASOCONSTRICTOR RESPONSE TO LOWER BODY NEGATIVE PRESSURE IN YOUNG OBESE ADULTS: THE PRELIMINARY FINDING

Kanokwan Bunsawat, Georgios Grigoriadis, Bo Fernhall, Tracy Baynard
University of Illinois at Chicago, Chicago, USA

Background: Elevations in muscle sympathetic nerve activity (MSNA) and sympathetic vasoconstrictor responsiveness to sympathoexcitation are associated with increased cardiovascular risks, which affect hemodynamics, and have been reported in obese adults with metabolic syndrome (1-3). It remains unclear whether this observation may also be present in young metabolically healthy obese adults.
Purpose: To compare sympathetic vasoconstrictor and hemodynamic responsiveness to lower body negative pressure (LBNP, -20 mmHg) in young normal-weight (NW) vs. obese (OB) adults.
Method: Eleven NW (female=6; 25±2 yrs; 22.4±0.6 kg/m2) and 13 OB adults (female=6; 27±1 yrs; 32.7±0.6 kg/m2) underwent 2-min of LBNP in the supine position. Ultrasonography [brachial diameter, forearm blood flow (FBF), forearm vascular conductance (FVC)], MSNA [burst frequency, total MSNA, sympathetic vascular transduction], and beat-to-beat hemodynamics [heart rate (HR), mean arterial pressure (MAP), total peripheral resistance (TPR), cardiac output (CO), stroke volume (SV), systemic compliance (SC)] were reported. FBF and FVC were normalized to lean forearm mass, and TPR, CO, SV, and SC to body surface area.
Results: Baseline MAP was lower in OB ($P<0.05$). In response to LBNP, normalized FBF, FVC, SV, CO, and SC decreased whereas TPR increased similarly in both groups ($P<0.05$). Brachial diameter and HR did not change in both groups. MAP decreased similarly by ~2-4 mmHg, but the values were lower in the OB group ($P<0.05$). Burst frequency, total MSNA, and sympathetic vascular transduction increased similarly in both groups ($P<0.05$).
Conclusion: Young metabolically healthy obese adults did not exhibit altered sympathetic vasoconstrictor responsiveness under resting condition.
References
1. Straznicky NE, Grima MT, Sari CI, Eikelis N, Lambert EA, Nestel PJ, et al. Neuroadrenergic dysfunction along the diabetes continuum: a comparative study in obese metabolic syndrome subjects. Diabetes. 2012; 61(10): 2506-16.
2. Huggett RJ, Burns J, Mackintosh AF, Mary DA. Sympathetic neural activation in nondiabetic metabolic syndrome and its further augmentation by hypertension. Hypertension. 2004; 44(6):847-52.
3. Kuniyoshi FH, Trombetta IC, Batalha LT, Rondon MU, Laterza MC, Gowdak MM, et al. Abnormal neurovascular control during sympathoexcitation in obesity. Obesity research. 2003; 11(11):1411-9.

8.9
REDUCTION IN MYOCARDIAL WALL STRESS AND DELAYED MYOCARDIAL RELAXATION DURING EXERCISE

Haotian Gu, Xiaoli Zhang, Benyu Jiang, Sally Brett, Phil Chowienczyk
King's College London, UK

Introduction: Myocardial wall stress (MWS) is thought to be the mechanical stimulus to ventricular hypertrophy (1,2). The objective of this study was to examine the effect of exercise on time-varying MWS (3).
Methods: Twelve subjects, aged 42.0 ± 16.8 (mean ± SD) years, systolic blood pressure (BP) (128 ± 11mmHg), were studied before and during peak bicycle exercise (85% of target heart rate). We estimated MWS from 3D transthoracic echocardiographic imaging of the left ventricle (LV) and LV pressure was derived from carotid tonometry during systole. Carotid pressure calibrated by mean and diastolic BP was used to calculate time-varying LV wall stress from endocardial and epicardial volumes obtained from Philips 3DQ analysis package. Time of onset relaxation (TOR) was defined as percentage of time to peak wall stress to ejection duration.
Results: There was a significant reduction in peak and mean MWS during exercise (rest 435.3±25.3 VS exercise 385.9±22.5, $p=0.001$ and 387.3±24.2 VS 368.7±19.6 kdynes/cm2, $p=0.016$), despite significant increase in systolic BP (128±3 VS 210±6 mmHg, $p<0.001$). LV end-diastolic volume (EDV) (119.3±9.4 VS 95.2±7.8ml, $p<0.001$) and volume at time of peak MWS (86.5±7.0 VS 68.3±6.3ml, $p=0.001$) were reduced significantly during exercise, but TOR was delayed (24.5±1.2 VS 31.0±1.6%, $p=0.003$).
Conclusion: Peak and mean MWS were reduced during peak exercise as a result of reduction in pre-load, despite of significant increase in systolic BP. But there was evidence of delayed myocardial relaxation during exercise.
References
1. Grossman W, Jones D, McLaurin LP. Wall stress and patterns of hypertrophy in the human left ventricle. The Journal of Clinical Investigation 1975; 56:56-64.
2. Ganau A, Devereux RB, Pickering TG et al. Relation of left ventricular hemodynamic load and contractile performance to left ventricular mass in hypertension. Circulation 1990; 81:25-36.
3. Chirinos JA, Segers P, Gupta AK et al. Time-varying myocardial stress and systolic pressure-stress relationship: role in myocardial-arterial coupling in hypertension. Circulation 2009; 119:2798-807.

8.10
BRACHIAL ARTERY FLOW-MEDIATED DILATATION: DIFFERENT PATTERNS OF WALL SHEAR RATE INCREASE DURING REACTIVE HYPERAEMIA

Kunihiko Aizawa [1], Sara Sbragi [2], Alessandro Ramalli [3], Piero Tortoli [3], Francesco Casanova [1], Carmela Morizzo [2], Clare Thorn [1], Angela Shore [1], Phillip Gates [1], Carlo Palombo [2]
[1]*Diabetes and Vascular Medicine Research Centre, NIHR Exeter Clinical Research Facility, University of Exeter Medical School, Exeter, UK*
[2]*Department of Surgical, Medical, Molecular Pathology and Critical Care Medicine, University of Pisa, Italy*
[3]*Department of Information Engineering, University of Florence, Italy*

Background: Wall shear rate (WSR) is considered an important stimulus for flow-mediated dilatation (FMD). However, its estimation by conventional ultrasound is challenging due to inherent difficulties of velocity estimation near the arterial wall. To evaluate how WSR influences brachial artery FMD, we used a prototype Doppler ultrasound system which provides simultaneous estimates of WSR at near and far walls and continuous arterial diameter tracking.
Methods: Data from 33 young healthy individuals (27.5±4.9yrs, 19F) were analysed. FMD was assessed with a conventional reactive hyperaemia technique using Ultrasound Advanced Open Platform (ULA-OP). All acquired raw data were post-processed using custom-designed software to obtain WSR and diameter parameters.
Results: Baseline diameter and FMD were 3.29±0.45 mm and 6.54±3.54 %, respectively. During hyperaemia, we observed two distinct patterns of increased WSR: monophasic (MOP, n=15 fast increase reaching peak WSR at once) and biphasic (BIP, n=18 fast followed by slow increase before reaching peak WSR). In BIP, peak WSR (657±153 sec-1 vs 522±132 sec-1) and WSR area under the curve until peak dilation (20398±6265 au vs 13530±5592 au) were significantly greater than in MOP (both $p<0.05$). Absolute diameter increase was significantly greater in BIP (0.24±0.10 mm) than in MOP (0.15±0.09 mm, $p<0.05$). Percentage diameter increase tended to be greater in BIP (7.6±3.3 %) than MOP (5.3±3.5 %, $p=0.08$).
Conclusions: These results demonstrate that there are distinct WSR increase patterns during hyperaemia, and that these patterns are associated with differences in the magnitude of hyperaemic WSR. Our observations suggest that