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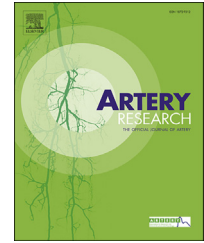
6.3: ARTERIAL STIFFNESS IS ASSOCIATED WITH LOW-DENSITY NON-CALCIFIED CORONARY PLAQUES IN PATIENTS WITH TYPE 2 DIABETES AND HEALTHY CONTROLS

Kristian L. Funck, Esben Laugesen, Kristian Oevrehus, Jesper M. Jensen, Bjarne L. Noergaard, Damini Dey, Troels K. Hansen, Per L. Poulsen

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6.1

PERIPHERAL ARTERY DISEASE AND CENTRAL HEMODYNAMIC MODIFICATION

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Peripheral arterial disease (PAD) affects the hemodynamics of the lower limbs¹ and is associated with increased cardiovascular risk and mortality². The aim of this study was to evaluate central hemodynamics and to test the relationships between lower ankle-pressure index (ABI) and Augmentation index (Aix)^{3,4}. In 242 PAD patients (mean age 67±9.8 years), Augmentation index (Aix) carotid-femoral pulse wave velocity (c-fPWV), pulse pressure amplification (PPA) aortic pulse pressure (aPP) and subendocardial viability ratio (SEVR) were measured using applanation tonometry^{5,6}. The ABI values were obtained using an 8-MHz Doppler probe⁷. c-fPWV was similar (0.164) in both sexes, Aix was higher ($p < .0001$), aPP was marginally higher ($p = 0.062$) PPA and SEVR were lower ($p = 0.013$), ($p < .0001$) in women with PAD. In the multiple regression model Aix was associated with MAP ($p < .0001$), age ($p = 0.0003$), smoking history ($p = 0.013$), c-fPWV ($p = 0.016$) diabetes ($p = 0.039$) and female sex ($p = 0.050$). In this large PAD population Aix is increased in women with PAD but is not associated with a lower ABI. Furthermore, it remains uncertain whether Aix in women with PAD provides more information concerning the prognosis of these high-risk patients.

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6.2

IMPACT OF DIABETES ON ARTERIAL STIFFNESS

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Objectives/Background: The purpose of our study was to examine the impact of diabetes on arterial stiffness.

A systematic review, published by Cecelja and Chowienzyk (1), describes that pulse wave velocity (PWV), is highly predictive of cardiovascular events, and PWV is associated with age and blood-pressure, but other pressure-independent risk factors including: dyslipidemia, smoking, diabetes, obesity remain inconsistent in many studies.

Methods: We included 796 patients, 398 of whom had diabetes. Patients were separated according to age, and we used the normal values for PWV described by Boutouyrie et al (2). We analyzed time of disease, diabetes control, and their impact on PWV.

A Mobil-o-Graph device was used to analyze the PWV, and a Stata 9.0 software was used for the statistics analysis.

Results: We found that diabetes is associated with an increase in PWV (OR: 1.6 $p < 0.01$) and the diabetes control also had influence in the PWV increase, which means that an glycated hemoglobin above 7.0% had an OR: 2.4, $p < 0,001$.

When we analysed the time of diabetes diagnosis, the longer duration of disease (> 120 months) had thirty-eight times more risk to increase the PWV, and those that had been diagnosed between 61 to 119 months had approximately three times more risk to increase the PWV.

Conclusions: In our study we found that diabetes had increased the pulse wave velocity.

Diabetes control and duration of disease also had impact on arterial stiffness.

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6.3

ARTERIAL STIFFNESS IS ASSOCIATED WITH LOW-DENSITY NON-CALCIFIED CORONARY PLAQUES IN PATIENTS WITH TYPE 2 DIABETES AND HEALTHY CONTROLS

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Background: Arterial stiffness may provide non-invasive information about cardiovascular risk in patients with type 2 diabetes. We investigated the association between arterial stiffness and subclinical coronary atherosclerosis in patients with type 2 diabetes and healthy controls.

Methods: Patients with type 2 diabetes and controls were recruited from an on-going study on diabetes complications. Arterial stiffness (carotid-femoral pulse wave velocity [PWV]) was obtained by applanation tonometry (SphygmoCor[®], Australia) whereas volumes [mm³] of total [TP], calcified [CP], non-calcified [NCP], and low density non-calcified coronary plaques [LD-NCP] were obtained by coronary CT-angiography and analyzed by semi-automated software (Autoplaq[®], USA). A two-part model was used to describe the association between PWV and 1) the presence of plaques in all participants and 2) the extent of plaques in participants with coronary atherosclerosis.

Results: PWV and coronary atherosclerosis data were available for 49 patients and 63 controls (age 63±10 years, 49% males, diabetes duration 7.7±1.5 years). Patients had higher PWV than controls (9.6±2.4m/s vs. 8.4±1.8m/s, p<0.01). PWV was associated with the presence of plaques in crude analysis (odds ratio per 1m/s increase in PWV: TP 1.5, p<0.01, CP 1.4 p<0.01, NCP 1.4 p<0.01 and LD-NCP 1.3 p=0.03) but not in analysis adjusted for age, sex, blood pressure, and diabetes. In the presence of coronary plaques, PWV was associated with the extent of LDNCP (crude: 1.2 mm³/m/s, p<0.01 adjusted: 1.2mm³/m/s, p=0.02).

Conclusion: The presence and the extent of coronary atherosclerosis is associated with PWV in patients with type 2 diabetes and healthy controls.

6.4

LARGE AND SMALL ARTERY CROSSTALK IN PATIENTS WITH TYPE 2 DIABETES

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Background: Vascular complications to diabetes mellitus have, traditionally, been divided in to micro- and macroangiopathy. However, a growing body of evidence has put this categorical division into question, as large artery stiffness has been associated with microvascular complications in diabetics, e.g. diabetic retinopathy. The pathophysiology behind this association is poorly understood. The retinal arterioles lack sympathetic innervation and blood supply is autoregulated to accommodate changes in blood pressure and metabolic demand. Recently, dynamic vessel analysis of the retina, has made direct observation of the dynamic function of the microvascular bed of the retina feasible (spontaneous vessel oscillations). However, the crosstalk between dynamic retinal arteriole functioning and large artery stiffness remains to be elucidated.

Methods: We will include 20 type 2 diabetics and 20 sex- and age-matched controls. Arterial stiffness (carotid-femoral Pulse Wave Velocity) is assessed using applanation tonometry (SphygmoCor). Retinal blood supply regulation is examined using the Dynamic Vessel Analyzer under two conditions: i) during exposure to flickering lights which increases the metabolism of the retina, and ii) during static exercise (hand-weight lifting) which elevates systemic blood pressure.

Results: Results will be ready for presentation at the congress. Currently, 7 participants have been examined and 16 more participants have been recruited. Study completion September 2016.

Perspectives: This study provides new insight into large-small artery crosstalk. We hypothesize that large artery stiffness is associated with reduced spontaneous vessel oscillations and perturbed retinal blood flow regulation.

6.5

ASSOCIATION BETWEEN INCREASED ARTERIAL STIFFNESS AND HBA1C AND LDL CHOLESTEROL LEVEL IN TYPE 2 DIABETES PATIENTS

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Background: In patient with type 2 diabetes mellitus (T2DM) the atherosclerosis appear in younger age, in both gender and the cardiovascular risk is much higher. The aim of our study was to examine the association between pulse wave velocity (PWV) and glycated haemoglobin (HbA1c) and low density lipoprotein (LDL-C) level in patient with T2DM. (1,2)

Methods: We performed a prospective observational study, outpatient measurement included: aorta PWV measured by arteriograph, HbA1c and LDL-C level. The cut off-points are: PWV: 9 m/s, LDL-C: 2,5 mmol/l, HbA1c: 6%. In the first part of the analysis were included 169 patients with T2DM (106 men, 63 women, average age: 59 year), and were 152 patients (99 men, 53 women, average age: 59 year) in the second part. Linear regression analysis was carried using SPSS software. Values of p<0.05 were considered to be statistically significant.

Results: In the first investigation we found significantly higher PWV in 87 patients (51%), mean: 9,27 m/s. The LDL-C level was higher than 2,5 mmol/l in 67% of cases, mean: 2,935 mmol/l. The second investigation underline a strict linear association between PWV and HbA1c (means: PWV: 9,286 m/s, HbA1c: 6,792 %.)

Conclusion: Our studies show parallel association between elevated HbA1c and PWV, as well as between higher LDL-C and PWV, which represent the elevated arterial stiffness (AS). Measurement of arterial stiffness can provide additional information about cardiovascular risk in patient with T2DM, which support the importance of arteriograph the only type of non-invasive method for AS measurement. (3,4)

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6.6

AORTIC-BRACHIAL STIFFNESS MISMATCH IN PATIENTS WITH ARTERIAL HYPERTENSION AND TYPE 2 DIABETES MELLITUS

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Background: Patients with type 2 diabetes have a high risk of CVD. Arterial stiffness gradient is a new prognostic predictor of mortality previously assessed only in dialysis population¹⁻².

The aim of the study was to assess arterial stiffness and stiffness gradient in diabetic patients with arterial hypertension (AH).

Methods: The study included 55 patients with AH and DM (38% male, mean age 61.6±12.7 years), mean office BP 142.5±25.5/82.7±10.7mmHg. All patients receive combination antihypertensive therapy, 7.27% of patients received statins. Target BP values (<140/85 mmHg) were achieved in 52.7% of patients. Target HbA1c levels were achieved in 10.9% of patients. Carotid-femoral (CF) and carotid-radial (CR) PWV were assessed and increased arterial stiffness was defined as an elevation of pulse pressure