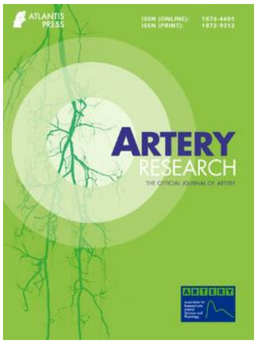

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P9.01: DETERMINANTS OF ARTERIAL STIFFNESS: A 16-YEAR FOLLOW-UP FROM THE WHITEHALL II STUDY

N.B. Johansen, D. Vistisen, M. Shipley, I.B. Wilkinson, C.M. McEniery, A.G. Tabák, M. Kivimäki, E.J. Brunner, D.R. Witte

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knowing whether reactivity of microvessels is different in young healthy adults with family history of hypertension and those without.
Experiments were performed on 38 healthy adults 19-24 years old. We measured ECG, arterial blood pressure and laser-Doppler (LD) flux in the skin of the fingertips first at rest in the supine position, then 3 minutes while having legs passively raised and finally 3 minutes with having them put down to supine position again. Subjects were divided in two groups: those that had hypertension in family history (N=17) and those that had not (N=21). There were no differences in systolic and diastolic blood pressure or in RR interval between the two groups. The study has ethical approval and the consent has been obtained from each subject.
The two groups of subjects showed significant difference in the LD flux while having legs lowered down again. Those without hypertension in family history exhibited greater LD flux than at rest (112.5±10%), while those with hypertension in family history exhibited smaller LD flux than at rest (83.6±8%) (t-test, $p<0.05$).
During physiological manoeuvre of lifting and lowering the legs in supine position young healthy adults show difference in the reactivity of skin vessels. It seems that sympathetic vasomotor action is pronounced or prolonged in subjects with hypertension in family history.

P8.08
A METHOD COMPARISON OF CENTRAL BLOOD PRESSURE MEASUREMENTS BY PULSECOR AND SPHYGMOCOR DEVICES

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Background: Estimated aortic (or central) systolic pressure (cSBP) differs from peripheral pressure and may be a better predictor of cardiovascular events. SphygmoCor® (AtCor, Sydney, Australia) uses applanation tonometery to derive cSBP by application of a generalised transfer function to radial pulse waveforms. PulseCor® (PulseCor, Auckland, New Zealand) is a new device that estimates cSBP from suprasystolic brachial cuff waveforms. We compared blood pressures measured by both devices.
Methods: 30 individuals (67.2±5yrs) underwent consecutive radial (SphygmoCor) and brachial (PulseCor) waveform measures. Method comparison was performed by Bland Altman analysis in Stata 11.0.
Results: Measurements made by the two devices were similar (Table 1). cSBP estimated by PulseCor tended to be higher than SphygmoCor, although the difference was within the American Association for the Advancement of Medical Instrumentation (AAMI) standards (< 5mmHg and SD_{diff} was <8mmHg). Bland Altman analysis showed no systematic bias between devices across the range of blood pressures measured.

Variable	PulseCor	SphygmoCor	Difference	LOA
Brachial SBP, mmHg	140.7 (13.1)	140.5 (13.0)	0.2 (1.4)	-2.4, 2.9
Brachial DBP, mmHg	84.7 (9.3)	84.7 (9.3)	0.0 (0.0)	0.0, 0.0
HR, bpm	65.4 (16.1)	64.6 (14.3)	0.8 (5.7)	-10.3, 11.9
Central SBP, mmHg	135.0 (12.8)	131.4 (13.0)	3.6 (4.3)	-4.9, 12.0
Central DBP, mmHg	85.8 (9.5)	85.4 (9.7)	0.3 (0.7)	-1.1, 1.7

DBP, diastolic blood pressure; HR, heart rate; SBP, systolic blood pressure; LOA, limits of agreement. Data are means (SD).
Conclusions: PulseCor and Sphygmocor give similar estimates of central blood pressures. The slightly higher cSBP measured by PulseCor could relate to the use of brachial rather than radial pressure to calibrate SphygmoCor.

P8.09
A COMPARISON OF CENTRAL BLOOD PRESSURES, AUGMENTATION INDEX AND PWV ESTIMATED BY «BPLAB VASOTENS» AND SPHYGMOCOR

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Aortic pulse wave velocity (PWV), wave reflection, measured as central augmentation index (AIx) and central (aortic) blood pressure (cSBP) are independent predictors for total and cardiovascular morbidity and mortality. The «BPLAB VASOTENS» is a new cuff-based, operator-independent device which obtains brachial BP waveforms derives (and saved in memory during 24-h) cSBP, AIx and PWV using brachial-to-aortic transfer function.
Aim: Compare «BPLAB VASOTENS» to standard techniques for measuring cSBP, AIx and PWV (SphygmoCor) in normotensive and hypertensive subjects.
Methods: 75 subjects (53 ± 12 years, 42% males) without cardiovascular diseases and with arterial hypertension were studied after 10 minutes of supine rest. Brachial pressure waveforms calibrated to brachial systolic and diastolic pressure were recorded using the «BPLAB VASOTENS» and radial pressure waveforms calibrated to brachial mean and diastolic pressure were recorded using the SphygmoCor. The corresponding cSBP, AIx, PWV measurements were compared between devices (cSBPbp vs cSBPshyg, Aixbp vs AIxshyg, PWVbp vs PWVshyg).
Results: There was good agreement between cSBPbp (123 ± 19mmHg) and cSBPshyg
(120± 18mmHg; $p<0.01$, $r=0.92$, $p<0.01$). Moderate results were observed for AIx − 27± 6 vs 27 ± 11 ($p=0.8$, $r= 0.64$, $p<0.01$) and for PWV − 7.7± 0.6 m/s vs 7.9± 1.9 m/s, $p=0.5$, $r= 0.45$, $p<0.01$).
Conclusions: the values of cSBP, but not Aix and PWV provided by the «BPLAB VASOTENS» and SphygmoCor devices show good agreement. Further comparative data are required in a larger sample size, and with invasive BP measurements.

P8.10
LOCAL CAROTID PULSE WAVE VELOCITY ASSESSMENT: A VIBRATIONAL APPROACH

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Arterial stiffness is a key parameter in evaluating vascular health. When locally evaluated at carotid site, it well correlates with the stage of degenerative atherosclerotic process and it could be considered an useful indicator of global cardiovascular risk.
At the present, the state-of-the-art methods for evaluation of local carotid stiffness are based on the analysis of vascular distensibility and local tonometry.
Aim of this work is to introduce a new system for local carotid pulse wave velocity (PWV) assessment based on the evaluation of the vibrations locally induced by the propagation of the arterial pulse pressure.
Eight young healthy subjects (28.4±2.1 years, 62.5% males, BMI 21.6±2.14 kg/m^2) have been recruited.
Two percutaneous accelerometers were placed on the neck of each subject few centimetres apart along a straight segment of the common carotid artery. The accelerometric signals were acquired and processed beat-to-beat in order to obtain the temporal value (i.e. pulse transit time, PTT) at which the maximal degree of similarity between them was obtained. In particular, ad-hoc fiducial points have been chosen, allowing an optimal signal alignment. The mean PWV, calculated from the distance (mean 3.81±0.58 cm) between the position of the two accelerometers and the PTT, was 3.16±1.09 m/s, a reasonable value for elastic artery of young people.
In conclusion, a new cheap, easy-to-use and non-invasive system for local carotid pulse wave velocity assessment based on the analysis of local vibrations is proposed. For its characteristics it might be considered as a valid alternative to available approaches.

Epidemiology
P9.01
DETERMINANTS OF ARTERIAL STIFFNESS: A 16-YEAR FOLLOW-UP FROM THE WHITEHALL II STUDY

N. B. Johansen [1], D. Vistisen [1], M. Shipley [2], I. B. Wilkinson [3], C. M. McEniery [3], A. G. Tabák [2], M. Kivimäki [2], E. J. Brunner [2], D. R. Witte [1]
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Background: Although several risk factors for cardiovascular disease (CVD) have been shown to be associated with arterial stiffness, the relative importance of these determinants is largely unknown. The aim of this study is to compare the relation between a wide range of baseline CVD risk factors and arterial stiffness 16 years later in a middle-aged population of civil servants.
Methods: We studied 3591 participants of the Whitehall II cohort. At baseline (1991-1993) blood pressure, BMI, waist and hip circumference, a lipid profile, fasting and 2-hour glucose were measured, and information on physical activity, alcohol intake, smoking habits, and employment grade was collected. At follow-up (2007-2009) arterial stiffness was assessed by carotid-femoral pulse wave velocity (PWV). Medication use, incident diabetes and coronary heart disease (CHD) events were assessed throughout

the follow-up period. The association between baseline determinants and PWV was assessed through linear regression analysis stratified by sex and adjusted for baseline age, BMI, employment grade, and mean blood pressure at time of PWV measurement. When relevant, analyses were further adjusted for incident diabetes, CHD events, antihypertensive medication, and lipid-lowering medication. The standardised regression coefficients were compared.

Results: Table 1 shows the characteristics of the study population. Figure 1 shows the standardised regression coefficients. For men, waist/hip ratio was the strongest determinant of PWV, whereas for women it was triglycerides.

Conclusion: We show that central obesity and dyslipidemia are strong determinants of arterial stiffness up to 16 years later, with particular emphasis on central obesity among men and triglycerides among women.

Table 1 Characteristics of the study population

	Men	Women
N	2652	939
Age (years)	48.6 (5.8)	48.7 (5.8)
Ethnicity (%)		
White	94.0 (93.0;94.9)	87.3 (85.0;89.4)
Asian	4.0 (3.2;4.8)	5.3 (4.0;7.0)
Black	1.6 (1.1;2.1)	5.6 (4.3;7.3)
Unknown/other	0.5 (0.2;0.8)	1.7 (1.0;2.8)
BMI (kg/m2)	24.8 (2.9)	24.8 (4.0)
Waist circumference (cm)	87.1 (8.6)	74.3 (10.7)
Hip circumference (cm)	96.4 (5.6)	96.0 (8.6)
Waist to hip ratio	0.90 (0.06)	0.77 (0.07)
Height (cm)	176.6 (6.6)	162.6 (6.5)
Diastolic blood pressure (mmHg)	80.2 (8.7)	76.1 (9.0)
Systolic blood pressure (mmHg)	120.6 (12.6)	116.3 (13.4)
Heart rate (bpm)	63.0 (10.4)	65.8 (9.6)
Total cholesterol (mmol/l)	6.4 (1.1)	6.4 (1.1)
HDL cholesterol (mmol(l)	1.3 (0.3)	1.7 (0.4)
LDL cholesterol (mmol/l)	4.4 (1.0)	4.2 (1.0)
Triglycerides (mmol(l)	1.4 (0.7)	1.0 (0.5)
Alcohol intake (units/week)	12.3 (13.3)	5.8 (6.9)
Moderate or vigorous exercise (hrs/week)	4.0 (4.0)	2.5 (3.6)
Employment grade (%)		
Administrative	42.3 (40.4;44.2)	17.4 (15.0;19.9)
Prof/exec	53.1 (51.2;55.0)	47.5 (44.3;50.7)
Clerical/support	4.6 (3.8;5.5)	35.1 (32.1;38.3)
Smoking habits (%)		
Never-smoker	52.0 (50.0;53.9)	62.5 (59.3;65.6)
Ex-smoker	38.4 (36.6;40.3)	26.6 (23.8;29.6)
Current smoker	9.6 (8.5;10.8)	10.9 (8.9;13.0)
Fasting plasma glucose (mmol/l)	5.3 (0.5)	5.0 (0.5)
2-hour plasma glucose (mmol/l)	5.4 (1.7)	5.7 (1.8)

Pulse wave velocity (m/s)	8.5 (2.0)	8.2 (2.0)
Mean blood pressure (mmHg)	94.3 (10.6)	91.1 (11.7)
Diabetes incidence (%)	12.5 (11.3;13.8)	13.4 (11.3;15.8)
Non-fatal CHD incidence (%)	7.1 (6.1;8.1)	6.4 (4.9;8.1)
Anti-hypertensive treatment history (%)	34.4 (32.6;36.2)	33.0 (30.0;36.1)
Lipid lowering treatment history (%)	32.6 (30.8;34.4)	25.7 (22.9;28.6)

Data are means (SD) or proportions (95% CI) except for the number of participants (N).
Data below the dotted line are follow-up characteristics.

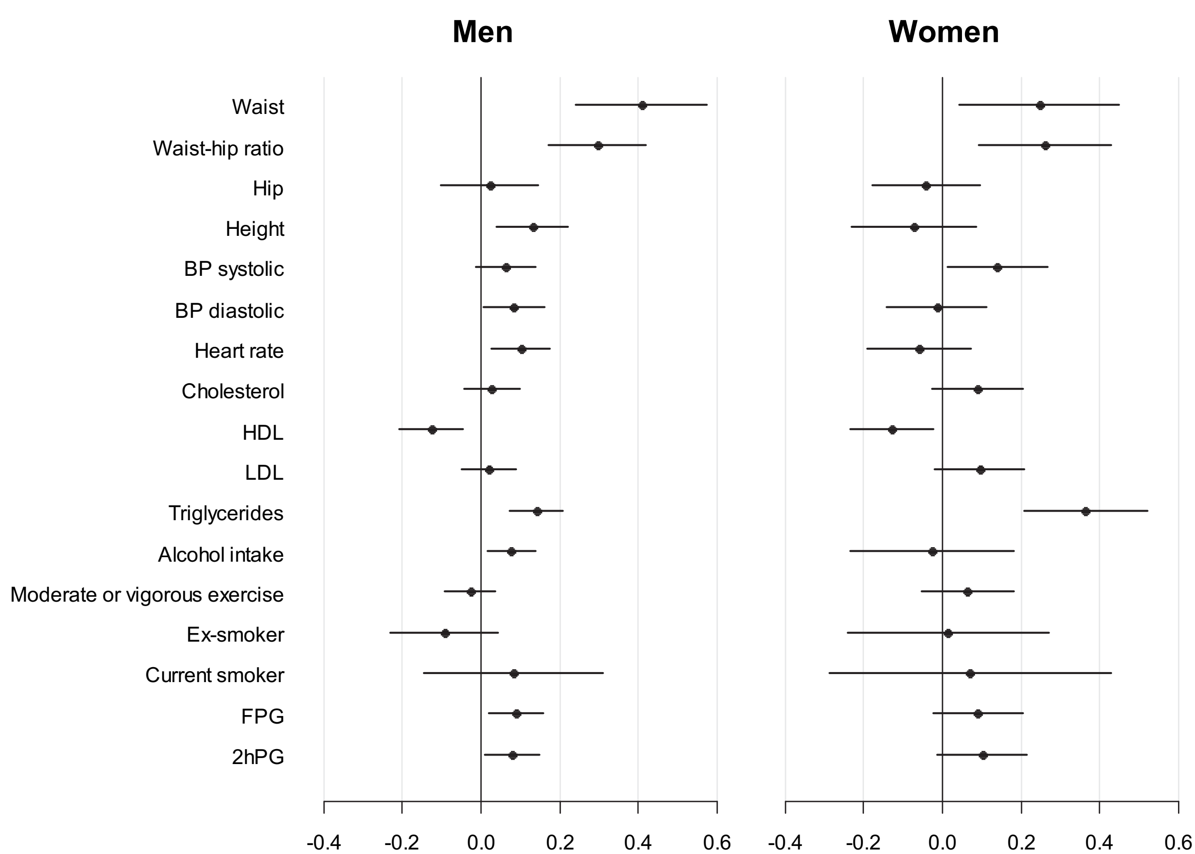

Figure 1 Standardised regression coefficients for predicting PWV. Coefficients are adjusted for baseline age, BMI, employment grade, and mean blood pressure at time of PWV measurement. When relevant, coefficients are further adjusted for incident diabetes, CHD events and medication.
FPG: fasting plasma glucose, 2hPG: 2-hour plasma glucose.