



## Artery Research

ISSN (Online): 1876-4401

ISSN (Print): 1872-9312

Journal Home Page: <https://www.atlantis-press.com/journals/artres>

### **P2.43: SMOKING HYPERTENSIVE MEN HAVE MORE PRONOUNCED EARLY ARTERIAL DAMAGE AS COMPARED TO NON-SMOKING HYPERTENSIVE MEN WITH HIGHER BODY MASS INDEX**

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**To cite this article:** L. Ryliskyte, M. Kovaite, J. Badariene, V. Dzenkeviciute, K. Ryliskiene, J. Kuzmickiene, A. Cypiene, A. Laucevicius (2008) P2.43: SMOKING HYPERTENSIVE MEN HAVE MORE PRONOUNCED EARLY ARTERIAL DAMAGE AS COMPARED TO NON-SMOKING HYPERTENSIVE MEN WITH HIGHER BODY MASS INDEX, Artery Research 2:3, 117–117, DOI: <https://doi.org/10.1016/j.artres.2008.08.409>

**To link to this article:** <https://doi.org/10.1016/j.artres.2008.08.409>

Published online: 21 December 2019

associated SNP (rs1081161) within the 9p21 region were genotyped. Aortic stiffness was decreased in male carriers of the rs10757274G and rs2891168G alleles. Accordingly, aortic compliance and distensibility were higher in men who carried the rs10757274G and rs2891168G alleles. Adjustment for age and mean arterial pressure had no effect on these associations. None of the SNPs were associated with either intima-media thickness or lumen diameter of the abdominal aorta. There were no associations between the T2D-associated rs10811661 SNP and any measure of aortic stiffness.

Impaired mechanical properties of the aortic wall may be a link between the association between chromosome 9p21 polymorphisms and vascular disease.

doi:10.1016/j.artres.2008.08.404

#### P2.39

#### INCREASED CARDIOVASCULAR RISK IN PATIENTS WITH A HYPERTENSIVE RESPONSE TO EXERCISE MAY BE EXPLAINED BY MASKED HYPERTENSION

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**Background:** A hypertensive response to exercise (HRE; defined as normal clinic blood pressure [BP] and exercise BP  $>210/105$  mmHg in men or  $>190/105$  mmHg in women) independently predicts incident hypertension and cardiovascular mortality. The mechanisms remain unclear but may be related to masked hypertension. This study aimed to assess the prevalence of masked hypertension and cardiovascular risk factors, including aortic reservoir function, in patients with a HRE.

**Methods:** Comprehensive clinical and echocardiographic evaluation (including central BP, aortic reservoir pressure, aortic pulse wave velocity by tonometry) and 24 hour ambulatory BP monitoring (ABPM) were performed in 81 untreated patients with HRE (aged  $54 \pm 9$  years; 60% male; free from coronary artery disease). Masked hypertension was defined as ABPM systolic BP (SBP)  $\geq 130$  mmHg and clinic BP  $<140/90$  mmHg.

**Results:** Masked hypertension was present in 50 patients (62%). These patients had higher left ventricular (LV) mass index ( $92.1 \pm 17.8$  g/m<sup>2</sup> versus  $77.2 \pm 17.9$  g/m<sup>2</sup>;  $p=0.01$ ) aortic reservoir pressure ( $104 \pm 9$  mmHg versus  $97 \pm 10$  mmHg;  $p=0.001$ ) and exercise SBP ( $226 \pm 15$  mmHg versus  $210 \pm 15$  mmHg;  $p<0.001$ ), despite no significant difference in aortic pulse wave velocity or central pulse pressure ( $p>0.05$  for both). Aortic reservoir pressure was significantly correlated with peak exercise SBP ( $r=0.34$ ;  $p=0.002$ ). The strongest independent determinant of LV mass index was the pressure of masked hypertension ( $\beta=0.37$ ;  $p=0.001$ ).

**Conclusions:** Aortic reservoir pressure is significantly elevated, and masked hypertension highly prevalent in HRE patients with a normal resting office BP. This may help to explain increased risk in patients with a HRE and clinicians should suspect masked hypertension in this population.

doi:10.1016/j.artres.2008.08.405

#### P2.40

#### CENTRAL AORTIC PRESSURE IS A BETTER DETERMINANT OF ANTI-HYPERTENSIVE RESPONSE THAN BRACHIAL PRESSURE IN YOUNG HYPERTENSIVE PATIENTS

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Aortic blood pressure (BP) has been shown as a stronger predictor of target organ damage than brachial BP. Whether pre-treatment aortic BP is a better determinant of early anti-hypertensive response than brachial BP is not known.

We analysed the pre and post treatment haemodynamic data on untreated hypertensive subjects ( $n=290$ ) aged  $51 \pm 0.6$  years, who had received in random fashion; ACE inhibitors, angiotensin receptor blockers, calcium antagonists & nebivolol (vasodilators) & non-vasodilating agents; atenolol & thiazide diuretics. Data were analysed using JMP Version 7.1.

Baseline aortic systolic BP showed a better correlation with reduction in either brachial or aortic systolic BP compared with brachial systolic BP. In subjects  $<50$  years, baseline aortic systolic BP showed a stronger correlation with brachial systolic response ( $r=0.38$ ,  $p<0.0001$ ) than brachial systolic BP ( $r=0.28$ ,  $p<0.001$ ). Baseline brachial systolic BP showed a poor correlation with reduction in aortic systolic ( $r=0.19$ ,  $p<0.05$ ) compared with baseline aortic systolic BP ( $r=0.37$ ,  $p<0.0001$ ). In those  $>50$  years, pre-treatment brachial ( $r=0.46$ ,  $p<0.0001$ ) and aortic ( $r=0.47$ ,  $p<0.0001$ ) systolic BP showed similar correlations. Baseline aortic systolic BP showed a better correlation with BP response to vasodilating anti-hypertensives

( $r=0.42$ ,  $p<0.0001$ ) than non-vasodilator agents ( $r=0.36$ ,  $p<0.0001$ ). In multiple regression analysis, gender, vasodilator agents and baseline aortic systolic BP emerged as independent determinants of brachial BP response with no significant contribution from brachial systolic BP.

Aortic BP is a better determinant of BP response than brachial BP, especially in young hypertensive patients and particularly to vasodilating antihypertensives and may guide choice of initial anti-hypertensive agent in the young patient.

doi:10.1016/j.artres.2008.08.406

#### P2.41

#### PULSE WAVE VELOCITY CORRELATES WITH LEFT VENTRICULAR SYSTOLIC FUNCTION IN NEVER-TREATED ESSENTIAL HYPERTENSIVES

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**Introduction:** Hypertension is associated with increased arterial stiffness. Arterial stiffness, which is a predictor of cardiovascular risk, has been shown to correlate with diastolic dysfunction of left ventricle in hypertensive patients.

**Hypothesis:** We assessed the hypothesis that arterial stiffness is associated with left ventricular systolic function in never-treated hypertensive patients.

**Methods:** We enrolled 195 consecutive essential hypertensives (mean age  $50 \pm 12$  years) with preserved left ventricular ejection fraction (LVEF  $>45\%$ ). Arterial stiffness was determined with carotid-femoral pulse wave velocity (PWV). LVEF was measured echocardiographically and calculated using the Teichholz method.

**Results:** Subjects were divided into tertiles according to PWV. There was a correlation of PWV tertiles with age ( $44 \pm 13$  vs  $49 \pm 11$  vs  $57 \pm 9$  years at the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> tertile, respectively). Mean blood pressure was similar across the tertiles ( $p=NS$ ). We observed a stepwise decrease of LVEF with increasing PWV. (Figure) Multivariable regression analysis showed that the inverse correlation of LVEF with PWV was independent of age, sex and mean blood pressure ( $p=0.028$ , adjusted  $R^2$  of model = 0.241).

**Conclusion:** Higher PWV is an independent predictor of a lower LVEF in never-treated essential hypertensives. This finding provides further insights into the role of arterial stiffness in left ventricular function.

doi:10.1016/j.artres.2008.08.407

#### P2.42

#### POSTURAL CHANGES HAVE A DIFFERENTIAL RESPONSE ON BRACHIAL, COMPARED WITH CENTRAL, SYSTOLIC BLOOD PRESSURE IN PATIENTS WITH HYPERTENSION

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**Background:** Clinic brachial blood pressure (BP) is typically recorded in the seated, supine and standing positions. However, it is unknown whether central BP may be differentially altered with postural changes, and this may have treatment implications. This study aimed to assess brachial and central BP during different postures in patients with hypertension compared with controls.

**Methods:** Study population comprised 41 patients with hypertension receiving medication (HTN; aged  $60 \pm 7$  years; 22 male), 26 untreated patients with masked hypertension (MaskHTN;  $57 \pm 9$  years; 19 male) and 36 normotensive controls (aged  $54 \pm 9$  years; 22 male). The average of two brachial and central BP's (by radial tonometry; SphygmoCor) were recorded in the seated, supine (after 3-5 minutes) and standing (after 2 minutes) positions.

**Results:** Supine brachial systolic BP (SBP) was significantly higher in patients with HTN ( $127 \pm 12$  mmHg) and MaskHTN ( $130 \pm 10$  mmHg) compared with controls ( $120 \pm 13$  mmHg;  $p<0.05$ ). As expected for the controls, seated brachial SBP was slightly, but not significantly ( $p>0.05$ ), higher than both supine and standing positions. This non significant pattern was similar for central SBP in the controls and MaskHTN patients, but not patients with HTN, whose standing central SBP ( $109 \pm 12$  mmHg) was significantly lower compared with the supine position ( $116 \pm 14$  mmHg;  $p<0.05$ ).

**Conclusion:** Posture has a differential effect on central, compared with brachial SBP in patients with treated hypertension. This highlights the importance of assessing central BP in these people, which may be particularly useful for managing patients with symptoms related to orthostatic hypotension.

doi:10.1016/j.artres.2008.08.408

## P2.43

## SMOKING HYPERTENSIVE MEN HAVE MORE PRONOUNCED EARLY ARTERIAL DAMAGE AS COMPARED TO NON-SMOKING HYPERTENSIVE MEN WITH HIGHER BODY MASS INDEX

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**Objective:** It is well known that smoking and obesity are cardiovascular risk factors. However, many smokers fear to stop, thinking that following increase in weight will counterbalance the positive effect of smoking cessation. Our aim was to analyze the effect of smoking and obesity on early arterial damage in hypertensive men.

**Methods:** Hypertensive men without cardiovascular disease were included into the study (n=88, age 48.8±4.1). All patients underwent detailed assessment of cardiovascular risk. Carotid ultrasound (Art Lab System V.2.0), measurements of arterial stiffness and aortic blood pressure by applanation tonometry (Sphygmocor v.7.01) and sphygmomanometry (Vasera VS-1000) were performed in order to evaluate early arterial damage.

**Results:** Smokers (n=30) were younger as compared to non-smokers (n=58) – 48.5±3.91 vs. 49.28±5.0 years, p<0.05. Non-smokers had higher body mass index (31.5±3.6 vs 29.6±4.0, p<0.05), heart rate (69.1±10.2 vs. 60.7±11.0, p<0.05), and aortic mean blood pressure (101±14.5 vs. 108±12.11), but not aortic pulse pressure (37.9±7.4 vs. 37.3±10.7, ns). However, the aortic augmentation index Alx/HR (22.5±9.7% vs. 15.6±8.9%, p<0.001), heart-ankle stiffness index adjusted for blood pressure (CAVI-right 7.9±0.9 vs. 7.3±1.3, CAVI-left 7.8±0.9 vs. 7.2±1.2, p<0.01) and intima media thickness (0.65±0.17 mm vs. 0.56±0.13 mm, p<0.05) were significantly higher in smokers as compared to non-smokers. Smokers also had higher prevalence of the carotid plaques (p<0.05). Carotid-radial and carotid-femoral pulse wave velocity (Sphygmocor) didn't differ significantly (respectively, 9.2±1.5 vs. 9.25±1.1 m/s; 8.6±1.6 vs. 8.54±1.3 m/s, ns).

**Conclusion:** Although non-smoking hypertensive patients tend to be older and more obese, the smokers have worse arterial parameters in our study group.

doi:10.1016/j.artres.2008.08.409

## P2.44

## INCREASED PULSE PRESSURE IS ASSOCIATED WITH LONG LEFT VENTRICULAR EJECTION DURATION IN ISOLATED SYSTOLIC HYPERTENSIVES

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**Background:** Apart from stiff arteries, increased pulse pressure is associated with increased left ventricular (LV) contractility. We investigated whether elevated LV performance can be derived from carotid artery diameter waveforms in hypertensives.

**Methods:** We obtained common carotid artery (CCA) diameter waveforms by ultrasound in 8 isolated systolic hypertension (ISH) patients (sys/dia: 154±17/77±13 mmHg, age 70±8 yrs). By dedicated signal processing we obtained, with good precision (<10%), left ventricular isovolumic contraction (ICT) and ejection durations (ET) from the diameter curve, as well as diastolic diameter (Dd), distension (ΔD), relative distension (ΔD/Dd), and distensibility (DC) and compliance coefficients (CC).

**Results:** Dd was 7.9±1.0 mm, ΔD was 0.30±0.12 mm, ΔD/Dd thus 4±2%; pulse pressure was 77±16 mmHg. DC was 10±5 MPa<sup>-1</sup> and CC was 0.5±0.2 mm<sup>2</sup>/kPa, clearly linking the elevated pulse pressure to reduced arterial stiffness. Heart rate was 76±18 min<sup>-1</sup> while LV ICT and ET were 40±7 ms and 311±46 ms, respectively. LV dP/dtmax, estimated from the diastolic blood pressure-to-ICT ratio, was 1991±566 mmHg/s, suggesting no conspicuous contribution of LV contractility to increased pulse pressure in ISH. Within the group, however, there was a large spread in LV performance primarily related to ET and heart rate. Interestingly, ET showed a strong correlation with pulse pressure (r<sup>2</sup>=0.85, p<0.01), suggesting long ejection duration contributes to high pulse pressure in some patients.

**Conclusions:** Increased left ventricular performance, as reflected by ejection duration, can be observed and discriminated in isolated systolic hypertensives by diameter waveform analysis.

doi:10.1016/j.artres.2008.08.410

## P2.45

## EVALUATION OF CENTRAL BLOOD PRESSURE AND AUGMENTATION INDEX IN PATIENTS WITH ISOLATED AMBULATORY AND ISOLATED OFFICE HYPERTENSION: THE VOBARNO STUDY

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Different BP patterns have been identified by the use of office and 24 hours BP measurement: sustained normotension (NT), isolated office hypertension (IOH), isolated ambulatory hypertension (IAH) and hypertension (HT). Pulse-wave analysis has been proposed for evaluation of central BP; "augmentation index" (Alx) is an accepted indirect index of arterial stiffness. Aim of our study was to assess the relationships between PWA and BP patterns in a general population in Northern Italy. **Methods:** In 242 untreated subjects (age 54±9 yrs, BMI 25±4, 47% males) radial artery applanation tonometry and PWA were used to derive central aortic pressures and Alx. All subjects underwent laboratory examinations and clinic and 24 h BP measurement. Subjects were divided into subgroups: NT (office BP<140/90 and 24 h BP<125/80 mmHg), IOH (office BP≥140/90 and 24 h BP<125/80 mmHg), IAH (office BP<140/90 and 24 h BP≥125/80 mmHg) and HT (office BP≥140/90 and 24 h BP≥125/80 mmHg).

**Results:** Patients with IAH and HT were older than NT (59.5±8.4 and 55.3±9.3 vs 51.1±6.4 yrs p<0.01). BMI was higher in IOH and HT than in NT (25.5±3.9 and 26.8±4.3 vs 23.7±3.3, p<0.01). After adjusting for confounding variables (including also mean BP and HR) Alx was significantly higher in IOH, IAH and HT in comparison to NT (31.1±1.0, 30.8±1.8, 31.3±1.0 vs 26.6±1.0, p<0.01). Central SBP was significantly higher in HT, but also in IOH and IAH, than in NT (HT 120.3±0.7, IOH 120.6±0.7, IAH 121.0±1.2 vs NT 117.8±0.7 mmHg, p<0.01). **Conclusion:** In a general population sample central SBP and Alx are greater in patients with sustained, office or ambulatory hypertension. In IAH, despite normal brachial BP, central BP is significantly increased, possibly contributing to increase cardiovascular risk.

doi:10.1016/j.artres.2008.08.411

## P2.46

## RELATION BETWEEN PULSE WAVE VELOCITY AND PREDICTORS OF CLINICAL OUTCOME IN ARTERIAL HYPERTENSION

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**Objective:** to evaluate the relation between pulse wave velocity (PWV), an independent marker of cardiovascular risk and other parameters with prognostic significance: intima media thickness (IMT), left ventricular hypertrophy (LVH) and flow mediated vasodilatation (FMD) in patients with essential arterial hypertension.

**Material and Methods:** 142 hypertensive patients (aged 50-75 years, 65% females, without diabetes) were studied before and after 6, 12 months of treatment with ACEI/channel blockers + Indapamide. PWV was assessed using Complior method, IMT and FMD using carotidian/brachial ultrasound respectively. LVH was defined by index of mass (LVMI) and geometric patterns.

**Results:** 1. PWV is strongly related with LVMI and concentric hypertrophy irrespective the gender, moment of evaluation or regimen of treatment (p<0.05). Correlation with eccentric hypertrophy is evident at baseline only for females (t-test). 2. PWV is related with carotidian IMT (r=0.38, p=0.01) at baseline; after 12 months the relation remains only in ACEI subgroup (r=0.42, p=0.03). 3. Correlation with FMD exists only after adjusting for cardiovascular risk factors (ANCOVA).

**Conclusion:** our results suggest the complexe interrelation between non-invasive parameters of atherosclerosis, which is influenced by cardiovascular risk profile and antihypertensive regimen. The combination of these measurements is of stronger clinical relevance.

doi:10.1016/j.artres.2008.08.412

## P2.47

## CAROTID PATHOLOGY AND RISK FACTORS IN HYPERTENSIVE PATIENTS FOR CEREBROVASCULAR DISEASE - CORRELATIVE CLINICAL, NEUROSONOGRAPHIC AND ECHOCARDIOGRAPHIC STUDIES

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