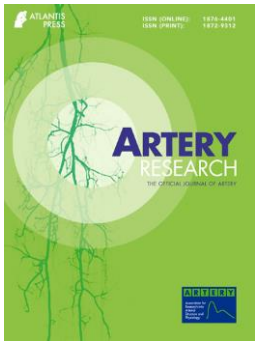

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P4.06: AMBULATORY CARDIAC REHABILITATION IMPROVES PULSATILE ARTERIAL HEMODYNAMICS – A PILOT TRIAL

M. Pfob, N. Mürzl, E. Müller, B. Eber, T. Weber

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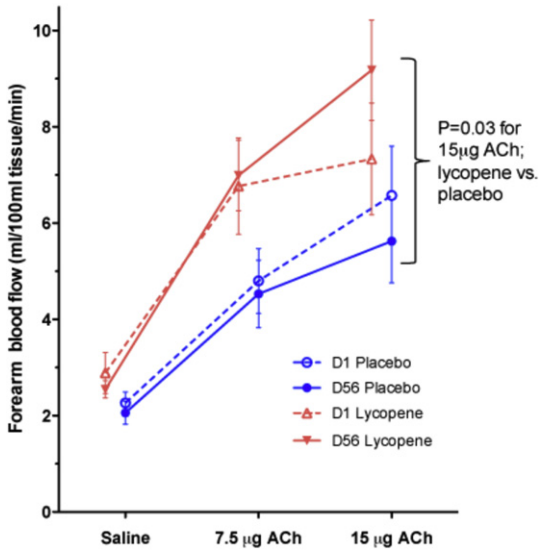

P4.04
INCREASED AORTIC PULSE WAVE VELOCITY (PWVAO) AND AORTIC AUGMENTATION INDEX (AIXAO) IN CHILDREN TREATED WITH ANTHRACYCLINES FOR MALIGNANT DISEASE

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Survivors of childhood malignancy have a significantly higher cardiovascular morbidity and mortality later in life. Anthracyclines are associated with marked cardiovascular toxicity and are therefore the major cause of cardiovascular events in this population group.
The aim of the study was to determine whether anthracyclines used for the treatment of malignant disease in childhood could increase arterial stiffness measured as the aortic pulse wave velocity (PWVao) and aortic augmentation index (AIxao).
A total of 119 children and adolescents aged 7-20 years were examined, 69 of them (mean age 13.69±4.45 years) having completed anthracycline therapy for malignant disease according to various protocols at least a year before. Study patients were free from clinical and laboratory signs of malignant or cardiac disease. Control group included 50 healthy children, mean age 12.68±3.22 years. Arterial stiffness was determined by measuring PWVao and AIxao using oscillometric method on an Arteriograph TensioMed device.
PWVao was higher (6.25±1.31 m/s *vs.* 5.64±0.66 m/s; $P<0.001$) and AIxao was higher (8.7±9.69% *vs.* 5.64±5.15%; $P=0.044$) in subjects with a history of anthracycline treatment as compared with control group.
PWVao and AIxao are significantly higher in patients treated a year or more before with anthracyclines as compared to healthy children. The effect of anthracyclines on late mortality in individuals treated for malignant disease in childhood may not be exclusively due to their cardiotoxicity, but also to the increased arterial stiffness

P4.05
AN EXAMINATION OF THE CARDIAC MECHANICS AND PULSE PRESSURE WAVEFORMS THAT UNDERPIN VENTRICULAR-ARTERIAL INTERACTION AT REST AND DURING EXERCISE

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Background: In healthy humans the left ventricle (LV) and the arterial system reciprocally interact to meet the circulatory demands of the body both at rest and during exercise. Ventricular-arterial interaction (VAI) can be quantified non-invasively using the ratio of arterial (E_a) and ventricular (E_{es}) elastances. However, E_{es} is a global measure of LV systolic function and E_a does not take into account the effect of wave reflections. Speckle tracking echocardiography (STE) and pulse wave analysis (PWA) allow for regional quantification of both cardiac and vascular functioning throughout the cardiac cycle. The purpose of this study was to characterise VAI using STE and PWA to explore the LV mechanics e.g. LV twist, and components of the pulse pressure waveform e.g. augmentation index (AIx), that underpin VAI at rest and during exercise.
Methods: 9 (7 male) healthy participants (43±7 years) underwent simultaneous STE and PWA at rest and during exercise.
Results: During exercise there was a decrease in E_a/E_{es} due to significant changes in E_{es} but not E_a. Whilst there were no significant changes in E_a during exercise both AIx and time to forward wave were significantly reduced. In contrast, the alteration in E_{es} was paralleled by significant changes in peak twist, time to peak twist, untwisting velocity and apical rotation.
Conclusions: The combined use of STE and PWA appears more sensitive to acute physiological changes induced by exercise than the classic VAI ratio: E_a/E_{es}. Future work will examine the sensitivity of combining STE and PWA to unmask subclinical cardiovascular pathology.

Variable	Rest: mean (SD)	Exercise: mean (SD)
E_a (mmHg/ml)	2.12 (0.56)	2.07 (0.56)
E_{es} (mmHg/ml)	2.92(1.13)	3.53 (1.25)*
E_a/E_{es} (mmHg/ml)	0.77 (0.22)	0.61(0.12)*
AIx (%)	12.67 (8.71)	5.44 (8.57)**
Time to forward wave (ms)	113.11 (10.3)	100.67 (14.97)*
Peak twist (°)	8.88 (2.99)	15.29 (5.27)*
Time to peak twist (ms)	387.54 (55.54)	307.08 (24.46)*
Untwisting velocity (°/sec-1)	-60.63 (13.30)	-128.13 (44.45)*
Apical rotation (°)	6.66 (3.65)	11.30 (5.52)*

*$p<0.05$; **$p<0.001$.

P4.06
AMBULATORY CARDIAC REHABILITATION IMPROVES PULSATILE ARTERIAL HEMODYNAMICS — A PILOT TRIAL

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Introduction: In patients with coronary artery disease (CAD), both arterial stiffness and wave reflections are increased and predict unfavourable cardiovascular events. Cardiac rehabilitation has the goal to reduce risk factors and slow the progression of the disease.
Aim: The aim of the study was to prospectively determine the impact of a 5-weeks ambulatory cardiac rehabilitation program on pulsatile hemodynamics.
Methods: Male patients following coronary interventions, bypass surgery or acute coronary syndromes underwent exercise training (35 minutes aerobic exercise at 50-70% of heart rate reserve 3x/week) and resistance training 2x/week. Before and after the program, carotid-femoral pulse wave velocity (cf-PWV) and wave reflections (Augmentation Index corrected for heart rate 75 — AIx@75) were measured, using applanation tonometry and a transfer function (SphygmoCor system). Exercise capacity was assessed with an incremental cycle ergometer protocol.
Results: 24 men (mean age 57 years) participated in the study. Following the intervention, brachial systolic blood pressure tended to decrease from 136.8 (SD 17.3) to 133.3 (SD 10.1) mm Hg ($p=0.328$). Brachial diastolic blood pressure changed from 82.7 (SD 8.3) to 79.2 (SD 6.9) mm Hg ($p=0.134$). Exercise capacity improved significantly from 154.2 (SD 31.1) to 168.5 (SD 31.9) Watt ($p<0.0001$). Cf-PWV decreased significantly from 8.7 (SD 1.7) to 7.9 (SD 1.9) m/sec ($p<0.05$) - Figure, and AIx@75 decreased significantly from 20.4 (SD 8.7) to 17.5 (SD 8.1) ($p<0.05$). Finally, exercise capacity was inversely and significantly related to cf-PWV ($r= -0.344$, $p<0.05$) and AIx@75 ($r = -0.603$, $p<0.0001$).

Conclusion: A structured ambulatory rehabilitation program improves pulsatile hemodynamics in CAD patients and may, thus, improve prognosis.

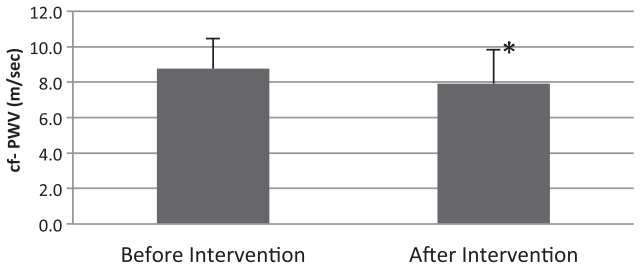

Figure Arterial Stiffness before and after 5 week ambulant cardiology rehabilitation cf-PWV, carotid — femoral pulse wave velocity

P4.07
RELATIONSHIP BETWEEN CENTRAL AND PERIPHERAL AMBULATORY AND OFFICE BLOOD PRESSURE WITH LEFT VENTRICULAR MASS IN HYPERTENSIVE PATIENTS

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Objectives: The purpose of the present study was to assess the relationship of peripheral and central, systolic and diastolic blood pressure with left ventricular mass, both measured in the office and under ambulatory conditions.
Methods: Cross-sectional study that included 71 never treated hypertensives (37 men, 52,1 %). 24 hours ambulatory peripheral and central (Mobil-O-Graph®) as well as office peripheral (OMRON®) and central blood pressure (Sphygmocor®) together with determination of left ventricular mass (LVM) by echocardiography were performed in all patients and adjusted for height$^{2.7}$ ($LVMI_{2.7}$) and body surface area ($LVMI_{BSA}$).
Results: The mean age was 45.8±12 years with office peripheral BP of 140/90 (SD±15/10), office central BP of 130/91 (SD±16/13), ambulatory peripheral BP of 128/84 (SD±13/12) and ambulatory central BP of 120/85 (SD±15/10) mmHg. The mean $LVMI_{2.7}$ and $LVMI_{BSA}$ was 49.3 g/m$^{2.7}$ and 104.2 g/m^2, respectively. In bivariate analysis systolic ambulatory central BP showed the greatest correlation ($r=608; p<0.0001$) with $LVM_{2.7}$, followed by systolic ambulatory peripheral BP (SBPper_24, $r=508; p<0.0001$). In multiple regression analysis, adjusting by age and gender, all systolic BP measurements were independently related to LVMI, but central, ambulatory SBP showed the closest association with LVMI, independently of adjustment for height$^{2.7}$ or BSA.
Conclusions: In our population of untreated middle aged hypertensives, systolic BP was more closely related to LVMI than DBP, peripheral BP showed a greater association than office BP, and central BP had a greater relationship to LWMI than peripheral BP. Variation of central systolic 24 hours blood pressure caused therefore the greatest variation of LVMI.

P4.08
AMBULATORY AND CENTRAL HAEMODYNAMICS ARE ELEVATED DURING HIGH-ALTITUDE HYPOXIA

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Background: High-altitude hypoxia may cause temporary increases in brachial BP, but the effect on more sensitive BP measures (24hr ambulatory and central BP) is unknown. This pilot study aimed to determine this, as well as the haemodynamic correlates of acute mountain sickness (AMS).
Methods: Measures of oxygen saturation (pulse oximetry), 24hr ambulatory BP (A&D-TM2430), brachial and central BP (including augmentation index; Pulsecor) were recorded in 10 adults (aged 27±4, 30% male) during a 16-day trek to Mt. Everest base camp, Nepal. Data was recorded at sea level (stage 1; <450m above sea level [ASL]) and at progressive ascension to 3440m ASL (stage 2), 4350m ASL (stage 3) and 5164m ASL (stage 4). The Lake Louise Score (LLS) was used to quantify AMS symptoms.
Results: Total LLS increased step-wise from sea level to stage 4 (0.3±0.7vs.4.4±2.0, $P=0.012$), whilst oxygen saturation decreased to 77±9% in a similar step-wise fashion ($P=0.001$). The highest recordings of 24hr ambulatory BP, daytime BP, night-time BP, brachial and central SBP and DBP, augmentation index and heart rate (HR) were achieved at stage 3, which was significantly greater than at sea level ($P<0.005$ for all). However, there was no difference in brachial or central PP, or PP amplification between stages ($P>0.05$ for all). Overall, 24hr ambulatory and night-time HR were strongly correlated with oxygen saturation ($r=-0.741$ and -0.608, both $P<0.001$) and LLS ($r=0.648$ and $r=0.493$, both $P<0.001$).
Conclusion: 24hr ambulatory BP, central BP and HR are elevated during high-altitude hypoxia, but AMS symptoms are only related to tachycardia.

P4.09
BASELINE AUGMENTATION INDEX AND PULSE PRESSURE AMPLIFICATION DETERMINE THE RESPONSE TO ANTIHYPERTENSIVE THERAPY

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Objectives: Essential hypertension is characterised by alterations in haemodynamics. Hence haemodynamic profiling could lead to improved blood pressure (BP) control in these patients. We tested if baseline haemodynamic indices predict the BP lowering effects of different classes of antihypertensive drugs in hypertensive patients.
Methods: In this double-blind placebo-controlled crossover study we randomised 53 treatment-naïve hypertensive patients to receive doxazosin 4 mg, candesartan 16 mg, bisoprolol 5 mg, isosorbide mononitrate (ISMN) 50 mg, and placebo daily for 6 weeks. Brachial and central BP, augmentation index (AIx), aortic pulse wave velocity (aPWV), stroke volume (SV), cardiac output (CO), peripheral vascular resistance (PVR), and pulse pressure amplification (PPA) were measured at baseline and after each drug.
Results: Baseline AIx and PPA determined brachial and central BP reduction with antihypertensive therapy, particularly with bisoprolol. In patients with low baseline AIx (1.7-28.9%) and high PPA (1.22-1.87), bisoprolol had a weak antihypertensive effect, while the opposite was observed in patients with high AIx (36.3-48.2%) and low PPA (1.05-1.11). With candesartan, BP reduction was the largest, regardless of baseline AIx or PPA levels. There were no significant differences in BP reduction between the baseline extremes of SV, CO, PVR or aPWV with any drug.
Conclusion: Our study suggests that haemodynamic profiling by AIx or PPA could serve as a valuable tool in management of hypertension, particularly if beta-blockers are considered for treatment. Among the drug classes and doses used, the angiotensin II receptor antagonist reduced BP the most regardless of the underlying haemodynamic profile.

P4.10
PRINCIPAL FINDINGS FROM THE FIRST RANDOMISED STUDY TO DETERMINE THE VALUE OF CENTRAL BLOOD PRESSURE FOR GUIDING MANAGEMENT OF HYPERTENSION: THE BP GUIDE STUDY

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Introduction: Central blood pressure BP could be a better method to assess risk related to BP because it predicts mortality independent of brachial BP. This current study is the first randomized trial to test the usefulness of central BP as a management tool for doctors treating patients with hypertension.
Methods: Participants with uncomplicated essential hypertension ($n=284$) were randomized to 12 months of treatment decisions guided by usual care (based on office, home and 24 hour ambulatory brachial BP) or, in addition, by central BP estimated using radial tonometry (based on age and sex-specific normal central systolic SBP values). Recommendations regarding titration of antihypertensive medication (increase, decrease or maintain dose) were provided to each participant and their general practitioner. Relevant clinical information (e.g. co-morbidities, LV mass, blood biochemistry and BP-related symptoms) were considered when making titration recommendations in all participants. The primary outcome measures are: 1) change in LV mass (by real time three dimensional echocardiography); 2) amount of medication used; and 3) quality of life. Analysis will be by intention to treat.