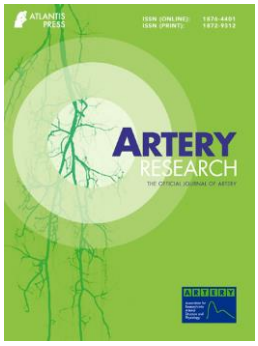

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P5.11: PHYSICAL FITNESS IMPROVEMENT AFTER CARDIAC REHABILITATION PROGRAM DEPENDS ON PWV

D. Agnoletti, S. Millasseau, G. Amah, C. Guiti, S. Gagey, J. Peroz, M. Duval, K. Abdennbi

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descending thoracic aorta sites using MRI (As and DsAoPWV). Local PWVs were calculated using Bramwell-Hill equation and all velocities were expressed in m/s. We included 72 normotensive non diabetic subjects (56.7% men), free from overt cardiovascular disease.
Results: In these 42±15 yrs-old subjects, having SBP/DBP 119±11/66±8 mmHg, PWV increased from proximal to distal segments: AsAoPWV=5.37±2.07 m/s; ArchPWV= 5.47±2.07 m/s; DsAoPWV=5.45±1.40 m/s; carPWV=5.79±1.5 m/s; and cfPWV=7.65±1.58 m/s. In univariate analysis, all PWVs strongly increased with age (r^2 ranging from 0.36 for ArchPWV to 0.54 for AsAoPWV; $p<0.0001$). The stiffness gradient between AsAoPWV and CarPWV reversed with ageing. ($r=0.42$, $p<0.001$). Mean blood pressure (MBP) was more strongly associated with CarPWV and cfPWV ($r=0.53/0.71$ respectively; $p<0.001$).
Conclusion: In this cohort of normotensive subjects we showed that age and BP had different effects on various segments of large proximal arteries. Age was a determinant of arterial stiffness in all carotid and aortic segments, with a more pronounced influence on AsAoPWV whereas MBP affected more aortic stiffness on the carotid-femoral pathway.

P5.08
ACUTE CHANGES IN CAROTID DIAMETER AND THICKNESS AFTER AND IRONMAN COMPETITION

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Objective: The aim of this study was to evaluate the acute effects of participation in Ironman triathlon competition on carotid properties, in relation to hemodynamic load.
Methods: 28 male triathletes (41±8 years), participating at the Ironman competition (swimming 3.8 km, cycling 180 km, running 42,2 km; 13 athletes performed half-race), underwent carotid and cardiac ultrasound examinations at rest and within 20' from the arrival. Right carotid diameter (D), distension (ΔD) and Intima-Media-Thickness (IMT) were estimated by an automatic system applied to ultrasound B-mode image sequences, and carotid pulse pressure (PP) by tonometry.
Results: The mean duration of the competition was 12:48±1:14 h (6:14 ± 0:37 hrs for the half-race). At the end of the competition the athletes showed increased heart rate (60.2±13.1 to 82.8±15.6 bpm, $p<0.0001$), unchanged mean BP (93±14 to 91±10 mmHg, p=ns), carotid PP (from 42 to 42 mmHg, p=ns), and stroke volume (64±14 to 59±16 ml, p=ns) and total body water (48.0±4.0 to 46.5±3.9 kg, p=ns). Cardiac output was significantly increased (5.5±1.2 to 6.7±2.4 l/min, $p<0.05$), and total peripheral resistances were reduced (17.6±3.9 to 14.8±4.6, $p=0.01$). D was increased (7.19±0.65 to 7.61 ± 0.76mm, $p<0.05$), while IMT was significantly reduced at the end of the competition (537±70 to 495±70 μm, $p<0.05$). ΔD and CC were not modified (588±139 to 568±168 μm and 1.12±0.58 to 1.22±0.54 mm^2/KPa, p=ns).
Conclusions: In an Ironman competition, strenuous exercise induced a marked carotid dilation and a decrease in IMT.

P5.09
INCREASED SYSTEMIC VASCULAR RESISTANCE DURING MODERATE EXERCISE INDEPENDENTLY PREDICTS A HYPERTENSIVE RESPONSE TO EXERCISE

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Background: A hypertensive response to exercise (HRE) at moderate intensity is an independent risk factor for cardiovascular events and mortality, but the underlying mechanisms are unknown. This study sought to determine the haemodynamic predictors of exercise blood pressure (BP) and an HRE.
Methods: Study sample comprised 75 consecutive patients (aged 57±10 years; 73% male) who were free from coronary artery disease and had completed a clinically indicated exercise stress test. Participants were stratified according to systolic BP (SBP) at moderate exercise intensity (Bruce protocol stage 2) with the highest tertile (SBP ≥169 mmHg) defined as an HRE. All participants underwent comprehensive haemodynamic assessment at rest and during moderate exercise; including, brachial and central BP, aortic stiffness, cardiac output (CO) and systemic vascular resistance (SVR; using bioimpedance).
Results: At rest, subjects with HRE had higher body mass index (BMI), triglycerides, aortic stiffness, brachial and central BP compared with normal exercise BP responders ($p<0.05$ for all), but no difference in resting SVR ($p>0.05$). During exercise, subjects with HRE had normal CO but significantly increased SVR ($p=0.033$) and, of all variables measured, this had the strongest correlation with exercise brachial and central SBP ($r=0.527$ and $r=0.626$ respectively; $p<0.001$). On multiple regression, exercise SVR ($\beta=0.357$, $p=0.002$) predicted exercise brachial SBP, independent of age, sex and BMI (Adjusted $R^2=0.399$, $p<0.001$).
Conclusions: Increased SVR during moderate exercise is independently related to exaggerated exercise SBP (HRE) in people undergoing clinically indicated stress testing. This suggests that abnormal peripheral vascular function may be a mechanism explaining exercise hypertension.

P5.10
MAJOR BRACHIAL-TO-RADIAL-SYSTOLIC-BLOOD-PRESSURE-AMPLIFICATION OCCURS IN HEALTHY PEOPLE AND IS SIGNIFICANTLY INCREASED WITH AGE

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Objectives: The reference standard for non-invasive central blood pressure (BP) measurement is radial tonometry calibrated using brachial BP. Brachial-to-radial-systolic-BP-amplification (Bra-Rad-SBP_{Amp}) may introduce error into central BP measurement but the magnitude of Bra-Rad-SBP_{Amp} in healthy people is uncertain. This study aimed to determine the magnitude of Bra-Rad-SBP_{Amp} as well as effects of ageing.
Methods: Forty healthy younger (28±5 years; 50% male) and 20 older (60±8 years; 50% male) participants underwent brachial and radial artery ultrasound measurement to identify SBP (1st Korotkoff sound) from the 1st Doppler flow inflection point during BP cuff deflation. Regional and local haemodynamics were recorded by ultrasound and tonometry. Bra-Rad-SBP_{Amp} was calculated by radial minus brachial SBP.
Results: Radial SBP was significantly higher than brachial SBP in both younger (118±12mmHg versus 110±10mmHg; $p<0.001$) and older (135±12mmHg versus 121±11mmHg; $p<0.001$) participants. However, the magnitude of Bra-Rad-SBP_{Amp} was higher in older age (14±7mmHg versus 8±7mmHg; $p=0.004$), and this was independent of heart rate, mean arterial pressure and sex. A higher proportion of older participants had major (>15mmHg) Bra-Rad-SBP_{Amp} (45% versus 12.5%; $p=0.028$). Recalibration of radial waveforms using radial versus brachial SBP resulted in higher central SBP in both younger ($p<0.001$) and older ($p<0.001$) age groups ($p<0.001$ between groups). Brachial artery stiffness was related to Bra-Rad-SBP_{Amp} in females only.
Conclusions: Major Bra-Rad-SBP_{Amp} occurs in healthy people and is significantly increased with age. These findings have implications for correct central BP estimation using radial tonometry and brachial BP calibration, whereby greater underestimation of central SBP is likely with advancing age.

P5.11
PHYSICAL FITNESS IMPROVEMENT AFTER CARDIAC REHABILITATION PROGRAM DEPENDS ON PWV

D. Agnoletti [1], S. Millasseau [2], G. Amah [3], C. Guiti [3], S. Gagey [3], J. Peroz [3], M. Duval [3], K. Abdennbi [3]
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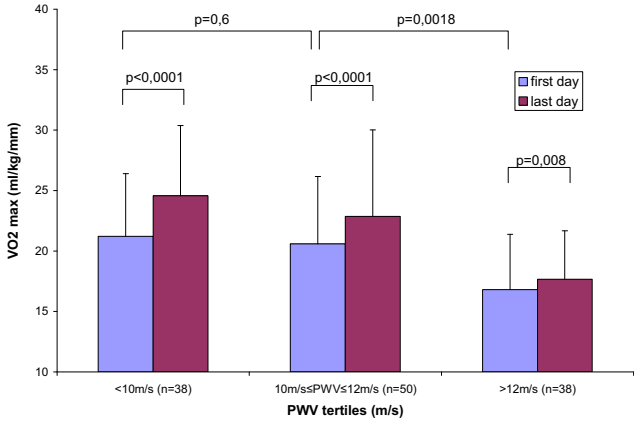
Aortic pulse wave velocity (PWV) is a measure of vascular organ damage. After a cardiac event, patients can be proposed to follow an educational and exercise program to prevent future events and improve their cardiovascular risk. We hypothesized that the improvement of aerobic performance will depend on their initial arterial health measured with PWV.
126 patients (99men, 27 women) followed cardiac rehabilitation programs of Bellan Hospital in Paris. Programs duration lasted from 1 to 4 months.

Carotid femoral PWV, blood pressure (MAP) and heart rate (HR) were measured in a quiet room in the morning of their first and last day prior to any exercise. VO2max was also measured at entry and at the end of the rehabilitation program.
PWV was correlated with age (R^2=0.23), MAP (R^2= 0.10) and VO2max (R^2=0.14) on the first day of the program. There was a small significant reduction in MAP (92±12 to 88±10 mmHg, p<0.001), in PWV (12.1±3.4 to 11.4 ± 3.1 m/s, p=0.002), an increase in VO2max (19.7±5.5 to 21.8±6.5 ml/kg/mm, p<0.001) but no change in resting HR (70±13 to 67±11 bpm p=0.02). When the cohort was separated into PWV tertiles at entry, patients with the lowest PWV exhibit the highest improvements in VO2max (see figure).
In our cohort, physical fitness improvement depends on entry arterial stiffness with highest results for patients with low PWV and poorest results for patients with high PWV.



P5.12
BRACHIAL-TO-RADIAL SYSTOLIC BLOOD PRESSURE AMPLIFICATION IS SIGNIFICANTLY BLUNTED IN PATIENTS WITH TYPE 2 DIABETES; UPPER LIMB HAEMODYNAMIC' S HAVE AN INFLUENTIAL ROLE

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Objectives: We recently found significant age-related increases in brachial-to-radial systolic blood pressure amplification (Bra-Rad-SBP_{Amp}), and this has implications for correct central SBP estimation. Patients with type 2 diabetes mellitus (T2DM) have vascular irregularities that may alter Bra-Rad-SBP_{Amp} and this study sought to determine the magnitude and mechanisms of Bra-Rad-SBP_{Amp} in these patients.
Methods: Twenty T2DM (64±8 years; 50% male) and 20 controls (60±8 years; 50% male) underwent simultaneous cuff auscultation and two-dimensional ultrasound imaging of the brachial and radial arteries. The 1st Korotkoff sound (denoting SBP) at each arterial site was identified from the first inflection point of Doppler flow during BP cuff deflation. Bra-Rad-SBP_{Amp} was calculated by radial minus brachial SBP. Local and systemic haemodynamics were recorded by tonometry and ultrasound.
Results: Radial SBP was higher than brachial SBP for both T2DM (136±16vs127±17; p<0.001) and controls (135±12vs121±11; p<0.001), and Bra-Rad-SBP_{Amp} was significantly lower in T2DM (9±8mmHgvs14±7mmHg, p=0.042). Central SBP was significantly higher in both controls and T2DM when radial pressure waveforms were calibrated using radial, compared with brachial SBP (p<0.001 both). The product of brachial artery flow velocity and diameter was significantly increased in T2DM (213±108 versus 315±144cm/s/mm, p=0.023), and this was inversely correlated with Bra-Rad-SBP_{Amp} (r=-643, p=0.003) even after adjustment for age and sex (β=-0.031, adjusted R^2=0.366, p=0.002).
Conclusions: Patients with T2DM have higher radial SBP than brachial SBP, but compared with controls, overall Bra-Rad-SBP_{Amp} is significantly blunted. Local haemodynamics influence the magnitude of Bra-Rad-SBP_{Amp} and overall these findings have implications regarding correct estimation of central BP.

P5.13
CHANGES IN VENTRICULO-ARTERIAL COUPLING IN PATIENTS WITH HYPERTENSION AND TYPE-2-DIABETES AFTER A PERIOD OF INTENSIFIED ANTIHYPERTENSIVE TREATMENT

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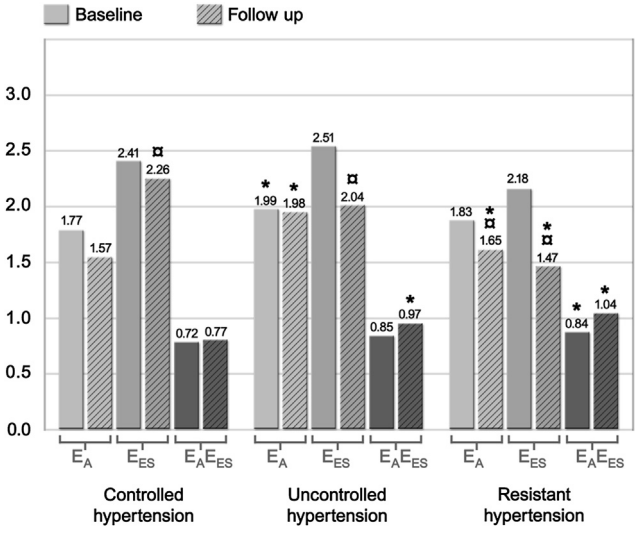
Objective: To examine changes in ventriculo-arterial coupling (VAC) and left ventricular systolic function (LVF_{SYS}) after a period of intensified antihypertensive treatment in patients with hypertension and type-2-diabetes.
Methods: Patients were categorized as controlled- (CH), uncontrolled- (UH) or resistant (RH) hypertensives based on ambulatory blood pressures (BPs) and number of antihypertensive agents. Central BPs were estimated using radial applanation tonometry and a generalized transfer function. LVF_{SYS} was evaluated using ejection fraction (EF) and S' (echocardiography). VAC was estimated as the ratio of effective arterial elastance (E_A) to end-systolic elastance (E_{ES}).
Results: 100 Patients were included (CH N=34, UH N=32, RH N=34). Median [interquartile ranges] follow up time was 6 [5;8] months.
At follow up patients with UH and RH had a significantly higher E_A and E_A/E_{ES} compared to patients with CH. Despite a significant reduction in central BPs of 6/4 and 8/3 mmHg there was a non-significant increase in E_A/E_{ES} in patients with UH and RH respectively. E_{ES} was significantly reduced in all hypertension groups (figure 1).
On average EF and S' was below 55% and 8 cm/s in all hypertension groups. In patients with RH EF and S' were further reduced from 48 [39;53] % to 42 [34;47] % (P=0.01) and 7 [6;8] to 7 [5;7] cm/s (P=0.01).
Conclusion: VAC and LVF_{SYS} did not improve despite a reduction in central BPs. Instead E_{ES} deteriorated in all hypertension groups. We speculate whether this is due to a reduction in myocardial perfusion or a gradual progression of diabetic cardiomyopathy.



P5.14
HIGH INTENSITY AEROBIC EXERCISE IN PATIENTS WITH ANKYLOSING SPONDYLITIS REDUCES ARTERIAL STIFFNESS: RESULTS FROM A RANDOMIZED CONTROLLED TRIAL

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Objective: Patients with ankylosing spondylitis (AS) are at increased risk of CVD. The etiological mechanism or how to reduce risk is not known. Exercise can reduce CV risk in the general population. The objective was to test whether high intensity aerobic exercise reduces central arterial stiffness.
Methods: A proof of concept randomized controlled pilot study. AS patients were allocated to exercise group (EG) or control group (CG). The 3 months exercise intervention consisted of aerobic high intensity training 40 minutes 3 days a week and muscular strength training 20 minutes twice a week. The control group received care as usual. Augmentation Index (AIx) and pulse