4.6: ELEVATION IN CENTRAL BLOOD PRESSURE DURING EXERCISE IS PREDOMINANTLY DRIVEN BY FORWARD-PROPAGATING WAVES: A FIRST IN MAN INVASIVE EXERCISE STUDY

M.G. Schultz, J.E. Davies, A. Black, P. Roberts-Thomson, A.D. Hughes, J.E. Sharman

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4.4 MODULATION OF ARTERIAL TONE INFLUENCES PULSE WAVE VELOCITY IN PROPORTION TO CHANGE IN ARTERIAL DIAMETER

H. Fok, P. Chowienczyk
King’s College London, London, United Kingdom

Nitric oxide (NO) is known to influence muscular conduit artery pulse wave velocity (PWV). Whether these changes are mediated exclusively by NO or may be a general consequence of a change in arterial tone is unknown. The aim of this study was to examine changes in local PWV over a range of arterial tone modulated by vasconstrictor/dilator drugs. Healthy normotensive men (n=7) aged 19-53 years were studied. The right brachial artery was cannulated using a 27 gauge needle. Nitroglycerin (NTG 0.03, 0.1, 0.3, 1 μg/min), phen tolamine (PHT 10, 30, 100 μg/min) and (NE 0.01, 0.02, 0.04 μg/min) alone and with PHT (100 μg/min) were infused intra-arterially on separate occasions. Radial artery diameter (RAD) was measured by high resolution ultrasound; PWV was measured over the brachial to radial path by simultaneous recording from brachial and radial blood pressure cuffs inflated to 60 mmHg. The path distance was taken from the proximal edge of the upper arm cuff to that of the wrist cuff. NE (0.04 μg/min) reduced RAD by 11.4±4.1% but when co-infused with PHT (100 μg/min) increased RAD by 5.8±3.5%. NTG (1 μg/min) increased RAD by (32.1±5.4%). Over this range of arterial tone, changes in PWV were closely related to those in RAD (figure, R = -0.89; P<0.05). This suggests that, under physiological conditions, PWV in muscular arteries is determined by smooth muscle tone rather than being influenced by a specific signalling pathway.

These observations suggest that profound micro-mechanical changes occur in diabetic blood vessels, both in the EL and collagen-rich ILR, and that pathological changes in the nano-structure of homeostatic components may play a role in driving localised remodelling in these tissues.

4.6 ELEVATION IN CENTRAL BLOOD PRESSURE DURING EXERCISE IS PREDOMINANTLY DRIVEN BY FORWARD-PROPAGATING WAVES: A FIRST IN MAN INVASIVE EXERCISE STUDY

M. G. Schultz 1, J. E. Davies 2, A. Black 3, P. Roberts-Thomson 4, M. D. Hughes 5, J. E. Sharman 7
1Menzies Research Institute Tasmania, Hobart, Australia
2International Centre for Circulatory Health, Imperial College, London, United Kingdom
3Royal Hobart Hospital, Hobart, Australia

Introduction: Exercise hypertension independently predicts cardiovascular mortality, but little is known on exercise central haemodynamics. This study aimed to determine contributions of arterial wave travel and aortic reservoir characteristics to central blood pressure (BP) during exercise. We hypothesised exercise central BP would be principally related to forward wave travel and aortic reservoir function.

Methods: Invasive pressure and flow velocity were recorded in the ascending aorta via sensor-tipped intra-arterial wire in 10 participants (age 55±10 years, 70% male) with normal left-ventricular function and free from obstructive coronary artery disease. Measures were recorded at baseline and during supine cycle ergometry. Using wave intensity analysis, dominant wave types throughout the cardiac cycle were identified (forward, backward, compression and decompression), and aortic reservoir and excess pressure were calculated.

Results: Central systolic BP increased significantly with exercise (19±12 mmHg, P<0.001). This was associated with significant increases in early systolic forward compression waves (15x10^6 ± 18x10^6 W.m^-2.s^-2, P<0.025) and forward decompression waves in late systole (9x10^6 ± 5x10^6 W.m^-2.s^-2, P<0.001). Despite significant augmentation in BP (+10%, P=0.023), backward (reflected) waves did not increase in magnitude (1-tx10^6±2x10^6 W.m^-2.s^-2, P=0.241). Excess pressure rose significantly with exercise (9±11 mmHg, P=0.001), and reservoir pressure integral fell (5x10^6 ± 5x10^6 W.m^-2.s^-2, P=0.010). The change in reflection coefficient negatively correlated with change in central systolic BP (r=-0.682, P=0.030).

Conclusion: Raised exercise central BP is principally driven by increasing aortic forward wave propagation generated by left ventricular ejection, and not wave reflection. These findings have relevance to understanding the pathophysiology of exercise hypertension.

Oral session 5
Free Communication Oral Presentations
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5.1 PULSE PRESSURE AMPLIFICATION AND RENAL FUNCTION IN HYPERTENSION

M. E. Safar 1,2
1Paris Descartes University, Paris, France
2Hotel-Dieu Hospital, Diagnosis and Therapeutic Center, Paris, France

In epidemiological studies including serum creatinine or estimates of glomerular filtration rate (GFR), pulse pressure (PP) emerged as significant predictor of cardiovascular risk and major determinant of age-associated decline in GFR. The finding is mainly observed in subjects with hypertension and/or renal failure but less in atherosclerotic subjects. Blood pressure was measured invasively in the ascending and abdominal aorta (at the level of kidneys) of 101 subjects undergoing coronary angiography. Independently of age, sex, and presence of coronary stenosis, amplification of PP between the ascending and terminal aorta was over 10 mm Hg (P<0.001), whereas mean blood pressure remained unchanged. Irrespective of PP measured in the ascending aorta and at the level of renal arteries, amplification was significantly related to proteinuria. Increased plasma creatinine and aortic pulse wave velocity were independently and positively correlated (P<0.001). The relationship between PP and renal function was mainly present in patients 60 years of age or older. Finally, renal transplant patients and their donors were recruited for evaluation of aortic stiffness and determination of the post-transplant decline trends in GFR. Determinants of filtration rate decline were evaluated at 1 year and at...