4.2: DISCREPANCY BETWEEN IN-VIVO MEASURE AND EX-VIVO CALCULATION OF PULSE WAVE VELOCITY IN RETINAL ARTERIES

Mahdieh Rezaeian, Arthur Leloup, Angela Schulz, Mojtaba Golzan, Stuart Graham, Alberto P. Avolio, Mark Butlin

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Background: Prevalence of overweight (OW) and obesity (O) in children and adolescents has increased in the past three decades. Obese children are prone to develop early cardiovascular (CV) morbidity in their adult life. Impaired arterial stiffness might be detected in this population. The aim of our study was to compare the arterial function parameters (AFPs) in O/OW patients and healthy subjects.

Methods: 6,816 subjects (3,668 boys) aged 3–18 years were recruited and categorised by their body mass index (BMI) into normal weight (N), OW and O groups regarding their age and sex. AFPs were measured by occlusive-oscillometric device. Propensity score matching was carried as statistic test.

Results: 19.9% (n = 1,536) of the population were O/OW, 911 (516 boys) were OW and 445 (273 boys) were O. PWV ao did not differ significantly between N (5.9 ± 0.8 m/s) and OW patients (5.9 ± 0.8 m/s); and N (6.0 ± 0.7 m/s) and O patients (6.0 ± 0.8 m/s). AIx ao was significantly lower in OW (9.3 ± 7.4% vs 7.6 ± 7.0%, p < 0.00001) and in O patients (9.7 ± 8.1% vs 6.6 ± 7.2%, p = 0.00001) compared to controls. No significant difference was found regarding SBP ao values between controls and OW and O groups (N = 110.7 ± 12.4 mmHg vs OW = 110.3 ± 11.9 mmHg; N = 115.6 ± 14.0 mmHg vs O = 114.3 ± 12.8 mmHg).

Conclusions: Aortic stiffness — expressed by PWV ao — did not differ between N and O/OW children and adolescents, however AIx ao was remarkably, significantly lower in O/OW patients. We may conclude that the pathophysiological consequences in the circulatory system due to childhood OW/O are compensated hemodynamically in these patients, presumably by decreasing total peripheral vascular resistance.

Oral Session IV — Models, Methodologies and Interventions

4.1 PROBING ARTERIAL STIFFNESS AT THE NANO-SCALE USING THE INTERNAL MAMMARY ARTERY AS A NOVEL TARGET

Riaz Akhtar 1, Zhuo Chang 2, Maria Lyck Hansen 3, Hans Christian Beck 1, Lars Melholt Rasmussen 3
1University of Liverpool, United Kingdom
2University of Liverpool, Liverpool, United Kingdom
3Odense University Hospital, University of Southern Denmark, Denmark

Introduction: Arterial stiffening is associated with structural and biomechanical alterations in the aorta. However, there are still gaps in our understanding as to how the structure and properties of arteries across the vasculature are altered with high PWV. Objective: To determine whether altered ultrastructural and nanomechanical properties are exhibited in the internal mammary artery (IMA) in high PWV patients.

Methods: Human IMA biopsies were obtained from patients with known carotid-femoral PWV. Patients were grouped as low PWV (8.5 ± 0.7 ms⁻¹, n = 8) and high PWV (13.4 ± 3.0 ms⁻¹, n = 9). With Peakforce QNM atomic force microscopy (AFM) the nanomechanical (elastic modulus) and morphological properties (collagen fibril diameter and D-Period) of the IMA were measured. Principal component analysis (PCA) was used to determine the relationship of nanomechanical and structural data with proteomics data (small leucine rich proteoglycans, SLRPs) [1] and patient metadata.

Results: PCA analysis shows that the nano-scale elastic modulus was one of the key variables which separated low and high PWV groups and was correlated with PWV. Furthermore, nano-scale alterations in adventitial collagen fibrils were evident. D-Period and collagen fibril diameter were found to be negatively correlated. Most SLRPs were closely grouped in the PCA analysis.

Conclusions: Although the IMA is not involved in the carotid-femoral pathway, patients with high PWV exhibited distinct alterations in the IMA at the nano-scale relative to those with low PWV. Our approach provides new insight into systemic structure-property changes in the vasculature, and also provides a novel method for characterizing small biopsy samples for arterial stiffening studies.