P5.1: FROM AORTIC FLOW VELOCITY TO CENTRAL PRESSURE: A NON-INVASIVE PROOF OF CONCEPT

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levels, and lipids profile were measured. Ambulatory blood pressure measurements and echocardiography were performed.

Results: LVH was detected in 34 out of 71 children. In children with LVH, significantly higher values of BP were observed in 24-hour measurements: systolic (119 vs. 109 mm Hg; p = 0.002), diastolic BP (73 vs. 65 mm Hg; p = 0.009) and MAP (89 vs. 81 mm Hg, p = 0.004). These significantly higher BP values were observed within day and night. Increased cholesterol level was found in 25, LDL in 12, TGL in 28, and a decreased HDL in 20 children.

In children with LVH higher BMI (18.6 vs. 16.7 kg/m²; p = 0.039) and lower albumin (41.5 vs. 45.4 g/l; p = 0.013), HDL (1.14 vs. 1.5 mmol/l; p = 0.001) and Ca levels (2.36 vs. 2.47 mmol/l; p = 0.03) were found. Obesity and low HDL level were independent LVH risk factors. The results indicate a 3-fold increase in the risk of LVH in children with hypertension (OR 3.18, p = 0.045), rising up when 2-3 risk factors were present (OR 6, p = 0.015).

Conclusions: Hypertension, a decreased HDL cholesterol level and overhydration have significant impact on the development of LVH in CKD children.

P4.1
FROM AORTIC FLOW VELOCITY TO CENTRAL PRESSURE: A NON-INVASIVE PROOF OF CONCEPT
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Estimation of aortic and left ventricular (LV) pressure usually requires measurements that are difficult to acquire during the imaging required to obtain concurrent LV dimensions essential for determination of LV mechanical properties. We describe a novel method for deriving aortic pressure from the aortic flow waveform. The target pressure waveform is divided into an early systolic upstroke and a diastolic decay, interposed by a late systolic portion described by a second-order polynomial. Pulse wave velocity (PWV), mean arterial pressure, diastolic pressure and diastolic decay are required inputs for the algorithm. The algorithm was tested using a) pressure data derived theoretically from pre-specified flow waveforms and properties of the arterial tree using a single-tube 1D model of the arterial tree and b) experimental data acquired from a pressure/Doppler flow velocity transducer placed in the ascending aorta (n = 18, mean+/−SD age: 63+/−11 years, aortic BP: 136+/−23 / 73+/−13 mmHg) at the time of cardiac catheterisation. For experimental data, PWV was calculated from measured pressures/flows and mean, diastolic pressures and diastolic decay were taken from measured pressure. Pressure reconstructed from measured flow agreed well with measured pressure (mean RMS error 0.7+/−1.0 mmHg). Similarly, for experimental data, pressure reconstructed from measured flow agreed well with measured pressure (mean RMS error 2.4+/−1.0 mmHg). First systolic shoulder and systolic peak pressures were accurately rendered (mean+/−SD difference 1.4+/−2.0 mmHg for systolic pressure). This is the first non-invasive derivation of aortic pressure based on fluid dynamics (flow and wave speed) in the aorta itself.

P5.2
FROM THE WAVE PROPAGATION MODEL TO A TRANSFER FUNCTION: A POSSIBILITY FOR PERSONALISATION
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Since aortic pressure cannot be measured noninvasively, pressure signals are often measured at more superficial arteries and a transfer function is applied to obtain a surrogate for the central pressure curve. These transformations are usually derived from measurements in a specific group of subjects and a generalised transfer function is calculated thereof. In contrast, in this work a one-dimensional wave propagation model is used to derive a patient-specific transfer function. A model of the arterial tree is combined with the theory from Womersley for travelling waves. To obtain a transfer function, it is sufficient to derive the transfer function from one arterial segment to its parent vessel by relating a stationary component and forward and backward travelling waves. To obtain a transfer function, it is sufficient to derive the transfer function from one arterial segment to its parent vessel by relating forward and backward travelling waves via the reflection coefficient of the