PULSE WAVE DYNAMICS IN THE CAROTID ARTERY: ASSESSMENT WITH HIGH-FIELD VELOCITY-ENCODED MRI

ACC Moderated Poster Contributions
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Background: It is hypothesized that aortic pulse wave reflection at the interface between a compliant aorta and stiffer carotid arteries limits the transmission of excessive pulsatile energy. Vessel stiffness can be expressed by pulse wave velocity (PWV: propagation speed of the flow wave through the artery). Velocity-encoded (VE) MRI is well-validated for accurate PWV-assessment. The purpose of this study was to use 3T VE MRI to evaluate aortic and carotid PWV as well as pulsatility damping in the carotid artery.

Methods: Thirteen healthy volunteers (4 male, mean age 25±3 years) underwent 3T MRI (Philips) to assess PWV in the aortic arch and the left carotid artery based on the transit-time method and one-directional through-plane velocity-encoded MRI (Figure 1). At the two levels of carotid PWV assessment, maximal velocity Vmax, minimal velocity Vmin and mean velocity Vmean during the cardiac cycle were calculated. From these values, the pulsatility index (PI: [Vmax-Vmin]/Vmean) and resistive index (RI: [Vmax-Vmin]/Vmax) were calculated.

Results: PWV was 20% higher (p<0.001) in the carotid arteries (PWV=5.8±1.0 m/s) as compared to the aorta (PWV=4.8±0.7 m/s). PI was 72% reduced in the carotid artery while RI lowered 32%.

Conclusions: Velocity-encoded MRI is suitable for evaluating the pulse wave transmission from the aortic arch towards the brain. The carotid artery revealed a stiffer vessel wall than the aortic arch, which creates a reflection site for incident waves.

Pulse wave dynamics in the aorta (A) and the carotid artery (B)