Editorial for "Aortic Pulse Wave Velocity Evaluated by 4D Flow MRI Across the Adult Lifespan"

Pulse wave velocity (PWV) is an established measure of arterial stiffness and is a strong predictor of cardiovascular events and all-cause mortality.[1] PWV represents the rate at which the pressure wave caused by the cardiac pumping travels through the arteries. As the arterial walls become stiffer, either due to advanced age or due to other conditions, the rate at which the pressure wave travels through the arteries increases.

Conventionally, PWV is determined by measuring the time delay of the arrival of the pulse wave at the carotid artery and the femoral artery[2] using tonometry, oscillometry, or Doppler ultrasound. In the field of magnetic resonance imaging, estimation of PWV has been performed by imaging the velocity of flow in the aorta, either using a two-dimensional time-resolved phase-contrast sequence with through-plane velocity encoding and multiple slices[3] or using a three-dimensional time-resolved phase-contrast (4D flow) sequence with multiple velocity encoding directions.[4,5] From these measurements, PWV can be calculated based on the distance and time delay of the flow profile in two or more imaging planes.

Establishing normative values for 4D-flow-derived PWV is important for future studies; however, such normative values are currently missing in the literature. In this issue of *JMRI*, the article "Aortic pulse wave velocity evaluated by 4D flow MRI across the adult lifespan" by Jarvis et al[6] used a 4D flow method to investigate differences in PWV in an age- and sex-stratified cohort of 100 healthy adults to better understand how PWV is impacted by normal aging. The evaluation also considered the correlation between PWV and cardiac functional parameters such as end-diastolic volume, stroke volume, myocardial mass, and mean aortic blood flow velocity.

As expected, the authors found that PWV increased with age, in concordance with previous work.[7] The increase was found to be approximately 1 m/sec per decade. Groupwise analysis based on stage of adulthood showed significant differences in PWV between groups. PWV was shown to correlate with other age-dependent factors such as decreased cardiac function and reduced aortic flow velocity; however, no difference in PWV due to aging was found between men and women. Previous studies have shown varying results with respect to sex, with some studies finding that the rate of PWV increases more with advancing age in men than in women,[8] whereas others did not find sex-related differences in PWV.[9] Another important aspect of this study was that it evaluated the repeatability of 4D-flow-derived PWV in a subset of the cohort. An intraclass correlation coefficient of 0.75 was found, indicating good test–retest repeatability. A limitation discussed by the authors is that the temporal resolution used in the study was lower than what was used in previous studies of 4D-flow-derived PWV. However, no formal consensus on suitable scan parameters for the determination of PWV has been established so far. Overall, this is an important study, and even though it may not be sufficient to establish normative values for 4D-flow-derived PWV on its own, the work by Jarvis et al successfully demonstrates the utility of 4D-flow-derived PWV for studying the impact of aging on the aorta.

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