Comparison of Aortic Lumen Area and Distensibility using Cine and Phase Contrast Acquisitions

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Introduction Aortic distensibility is calculated as (Ss-Sd)/Sd/dP, where Ss and Sd are the systolic and diastolic lumen areas and dP the pulse pressure. To assess distensibility values obtained from Cine and Phase Contrast (PC) sequences, we first implemented an automatic segmentation method and validated it against experts manual contouring of the lumen. Then, the distensibility values obtained for both Cine and PC sequences were compared.

Material and methods Data were acquired using a thoracic section perpendicular to both ascending and descending aorta at the level of the pulmonary artery bifurcation. The brachial pressure was recorded simultaneously in the magnet. To test the segmentation algorithm, PC aorta sections (860) were collected from 12 datasets acquired on three different (1.5T and 3T) scanners. Then, data from 50 subjects acquired on a GE Signa-Excite scanner were used to compare Cine and PC distensibility values in the ascending aorta.

Results The mean and worst Dice overlap measures were $0.945\pm$ 0.014 and 0.84, respectively. The manual intra- and inter- and the automated inter-operator variabilities were $8.43\pm6.58\%$, $10.09\pm8.29\%$ and $0.59\pm0.92\%$, respectively. Slope (a), offset (b) and Pearsons coefficient (r) of the linear regression and, mean (m) and standard deviation (SD) of the Bland Altman test were respectively: a=0.95, b=0.35 cm2, r=0.96, m=0.03 cm2, SD=0.66 cm2 when comparing PC lumen areas to Cine lumen areas; and a=0.47, b=1.27 1000mmHg-1, r=0.57, m=-1.07 1000mmHg-1, SD=2.01 1000mmHg-1 when comparing PC distensibility to Cine distensibility. The average values of distensibility obtained with Cine (4.42 1000mmHg-1) were higher than for PC sequences (3.34 1000mmHg-1), but both appeared quite consistent with those previously presented in the literature.

Conclusion Despite very similar Cine and PC estimations of the aortic area lumen, derived distensibility values in the ascending aorta appeared larger using Cine sequences.