The Influence of Left Atrial Wall Thickness and Curvature on Wall Strain in Patient-Specific Atrium Models

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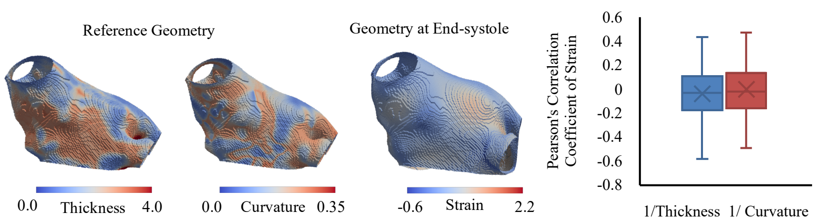
Fibrosis is thought to be a major contributor to atrial fibrillation. Atrial strain is a potential signal for fibrosis. Local left atrial (LA) strain can be impacted by local LA anatomy. This study investigated the correlation of local strain magnitude with local anatomy as described by curvature and wall thickness.

We created 3D motion models of the left atrium from retrospective gated computed tomography images from 8 patients. We calculated wall thickness and endocardial curvature across the left atrium at end-diastole (ED) then calculated left atrial endocardial area strain throughout the cardiac cycle, using the ED frame as the reference.

The average Pearson's correlation of end-systolic strain with inverse wall thickness and curvature was -0.076±0.095 and 0.017±0.081 respectively. The correlations between inverse wall thickness, curvature and the first four principal components of strain showed no greater dependence of strain on wall thickness or curvature. The LA was then divided into 18 regions and correlation was calculated regionally. Regionally, the range of correlation of strain at ES with thickness and curvature was (-0.58-0.43) and (-0.49-0.47) respectively.

Neither wall thickness nor curvature appear to strongly influence strain. This is consistent with either boundary forces acting on the atria or variations in regional stiffness impacting regional differences in strain.



Correlations of atrial area strain with wall thickness and curvature, with LA maps for 1 patient