Ultrasound Elastography of Abdominal Aortic Aneurysms

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Aim of our Research
The aim: Growth prediction of Abdominal Aortic Aneurysms (AAA) by combining functional ultrasound imaging (US) and patient-specific finite element (FE) modeling.

Methods
2D ultrasound imaging (Esaote) was performed in 10 healthy volunteers and 20 AAA patients (I). For five patients, 3D (+t) MRI data were available for comparison (II). The Young’s modulus (E) was estimated from the raw US and MRI data. The US data were processed using a 2D tracking algorithm. Volume over time was estimated by assuming axis-rotational symmetry. MRI data were processed with Hemodyn (Philips).

Results

Conclusion
Non-invasive assessment of the E-modulus in vivo distinguishes patients from normals (I). The 2D US results are in good correspondence with MRI (II) but seem low compared to 3D US (III). A next step will be combining 3D geometry, motion and material properties into patient-specific FE models. Stress-strain measurements yield elastin and collagen properties (IV). The latter might enable growth prediction based on elastin degradation or collagen deposition in the future.