4D MRI in TBADs: will it enable prediction of behaviour (aneurysm formation etc.), individualization of treatment and assessment of its effectiveness

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No Disclosures

Research programme

MAGNETIC RESONANCE IMAGING
1. Aortic biomechanics
2. Aortic haemodynamics

Outline

• Initiation of dissection
• Aneurysm formation
• Effect of medical and stent graft treatment

INITIATION OF DISSECTION
Intra-mural stress

\[ IMS = f(\text{strain}_{\text{circ}}, \text{strain}_{\text{long}}, \text{Vessel}_{i}) \]

Circumferential strain

Longitudinal strain

Material properties

Aortic stiffness

Aortic stiffness is greatest in patients with dissection

ANEURYSM FORMATION
Normal flow pattern
Right-handed helical flow
Left-handed helical flow

Stroke volume
The expansion rate correlated with the stroke volume in the false lumen (Spearman r=0.80 (95%CI =0.39 to 0.94), P=0.0029)

Velocity
The expansion rate correlated with the velocity in the false lumen (Spearman r=0.55 (95%CI =0.09 to 0.87), P=0.0480)

Helicity quantification
The expansion rate correlated with the amount of helicity (Spearman r=0.83, P=0.0154)

Wall shear stress
Decomposition of WSS into axial and circumferential components
Aneurysm formation with high circumferential component
Axial and circumferential WSS

Circumferential WSS was thirteen times greater than axial component of WSS in the false lumen.

**Conclusion**

- The management of aortic dissection is complex and patient-specific solutions are required
- 4D MRI can improve our understanding of initiation of dissection, aneurysm formation and the effect of medical and interventional treatment
- Widespread use of these methods