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Feasibility study of cardiac magnetic resonance elastography in cardiac amyloidosis

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Background

Magnetic resonance elastography (MRE) has been used clinically to assess tissue stiffness in diseases such as liver cirrhosis [1]. However, whether MRE is feasible for myocardial stiffness is unclear. Cardiac amyloidosis “stiffens the heart and leads to systolic and diastolic dysfunction [2,3]. MRI with delayed enhancement is helpful in the diagnosis, but is often precluded due to frequently co-existing renal dysfunction. MRE is contrast-free and could potentially be a useful tool for diagnosis and treatment monitoring. The aim of this feasibility pilot study was to determine if MRE could differentiate the myocardial stiffness between a cardiac amyloidosis patient and healthy control.

Materials and methods

We identified endomyocardial-biopsy proven cardiac amyloidosis patients from the amyloid clinic at the Mayo Clinic. Age-and gender-matched controls were recruited from campus postings. Baseline clinical information was acquired from chart review. Subjects underwent a one-time MRE using a vibrating driver on the chest. Images were acquired with a 1.5T MRI scanner (Optima 450W, GE Medical Systems, Milwaukee, WI) at the minimum allowed delay after the R wave using a cardiac-gated MRE spin echo echo planar imaging pulse sequence, at a vibration frequency of 140 Hz. Stiffness maps were generated using local frequency estimation inversion algorithm.

Results

One patient (58 years, male) and one control (57 years, male) were included in this pilot study. The patient was diagnosed with hereditary cardiac transthyretin amyloidosis with

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Declaration of interest

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valine 122 isoleucine mutation. He had NYHA functional class II symptoms. Echocardiogram showed grade 3 diastolic dysfunction and reduced ejection fraction (EF) of 46%. The control had normal diastolic and systolic function. Short axis myocardial stiffness maps from the MREs are shown in Figure 1. The mean stiffness values were significantly different: 15.7 kPa and 7.2 kPa for the patient and control, respectively.

Discussions and conclusions

Cardiac MRE was feasible in differentiating the myocardial stiffness between a cardiac amyloidosis patient and a healthy volunteer. A larger study is needed to further establish the reference ranges of myocardial stiffness, and determine diagnostic and prognostic values of MRE in cardiac amyloidosis patients and controls.

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Figure 1.
Short axis MRE myocardial stiffness maps of the patient with cardiac amyloid and control.