Abstract: Myocardial extracellular volume in patients with aortic stenosis undergoing valve intervention: a multicentre T1 mapping study

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On behalf: ECV400 Investigators

Topic(s): T1 and T2 Mapping, T2*

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Background

Myocardial fibrosis is a key mechanism of left ventricular decompensation in advanced aortic stenosis and can be quantified using cardiac magnetic resonance (CMR) imaging T1 mapping techniques.

Purpose

To assess T1 mapping measures of fibrosis in patients with severe aortic stenosis referred for aortic valve intervention, and determine their associations with clinical characteristics, disease severity and long-term clinical outcome.

Methods

In this international prospective cohort study, patients with severe aortic stenosis underwent CMR with T1 mapping prior to aortic valve intervention (surgical or transcatheter). Image analysis was performed by a single core laboratory and three T1 mapping measures (native T1, extracellular volume fraction [ECV%] and indexed extracellular volume [iECV]) were determined.

Results

Four-hundred patients (70±10 years, 60% male) with severe aortic stenosis (indexed aortic valve area 0.40±0.13 cm²/m²) from nine international centres were enrolled. Native T1 was higher in patients imaged at 3 T compared to 1.5 T (1213±57 versus 1050±48 ms, P>0.001), whereas ECV% did not vary by CMR scanner manufacturer, magnetic field strength or T1 mapping sequence (all P>0.30).

Native T1 did not show clear associations with clinical or imaging variables. ECV% correlated with increasing
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Native T1 did not show clear associations with clinical or imaging variables. ECV% correlated with increasing age, Society of Thoracic Surgeons Predicted Risk of Mortality score, known coronary artery disease, reduced peak velocity, increasing left ventricular mass, presence of late gadolinium enhancement and reduced ejection fraction (P<0.05 for all). Following adjustment for all clinical variables, ECV% remained associated with both left ventricular ejection fraction (P<0.001) and mass index (P=0.043). Similar associations were seen with iECV.

Aortic valve intervention was performed 19 [4, 61] days following CMR imaging. After a median of 3.8 [1.7, 4.5] years follow-up in 391 patients, 40 deaths were recorded. No prognostic association for native T1 was observed, even after adjustment for magnetic field strength. A progressive increase in all-cause mortality was seen across tertiles of ECV% (14.0, 28.5 and 53.7 deaths per 1000 patient-years; log-rank test, P=0.003). ECV% was independently associated with all-cause mortality following adjustment for age, sex, peak velocity, impaired ejection fraction and presence of late gadolinium enhancement (hazard ratio per unit increase in ECV%: 1.13; 95% (1.04 to 1.24), P=0.006). iECV was associated with all-cause mortality following adjustment for age and sex (hazard ratio 1.03 [1.00 to 1.06], P=0.04) but not following adjustment for other clinical variables.

Conclusion
In patients with severe aortic stenosis scheduled for aortic valve intervention, extracellular volume-based T1 mapping measures are robust, track with left ventricular decompensation, and independently predict all-cause mortality.