

AMILOIDOSI CARDIACA

Dr. M. Andriani

Cardiologia

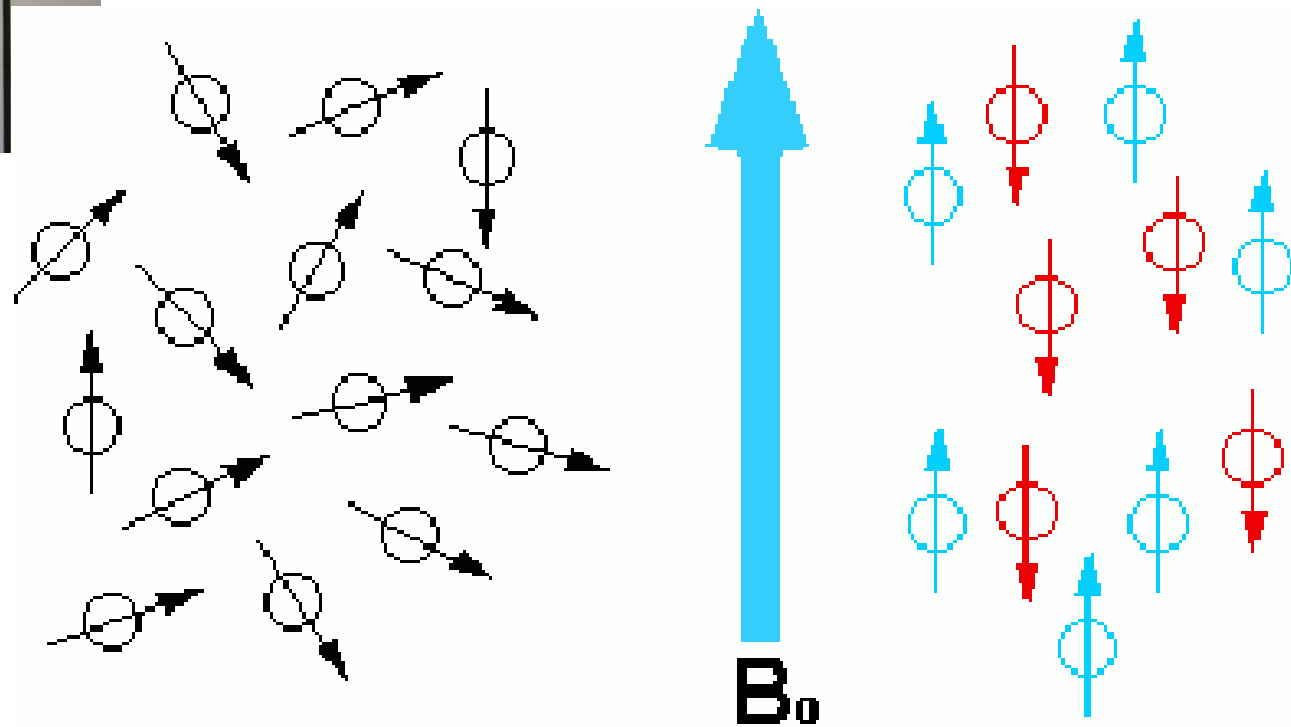
Città della Salute e della Scienza

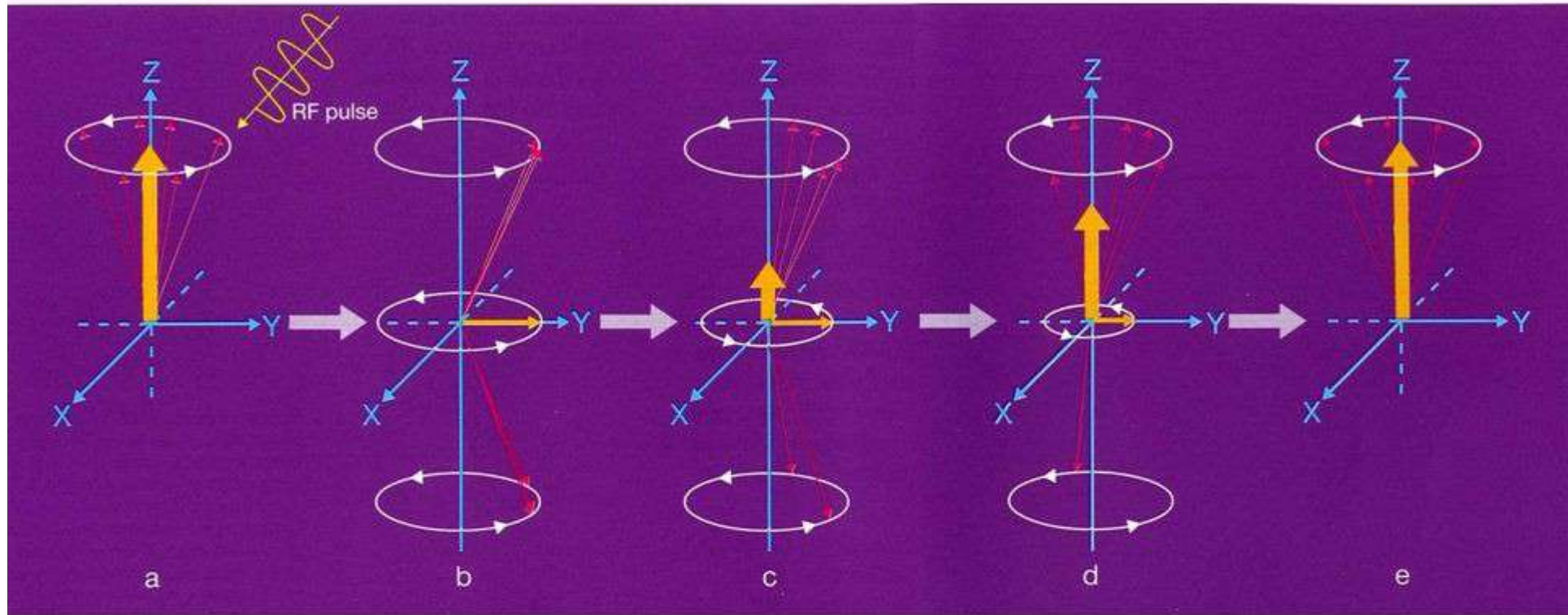
Torino

(Dir. Prof. G.M. De Ferrari)



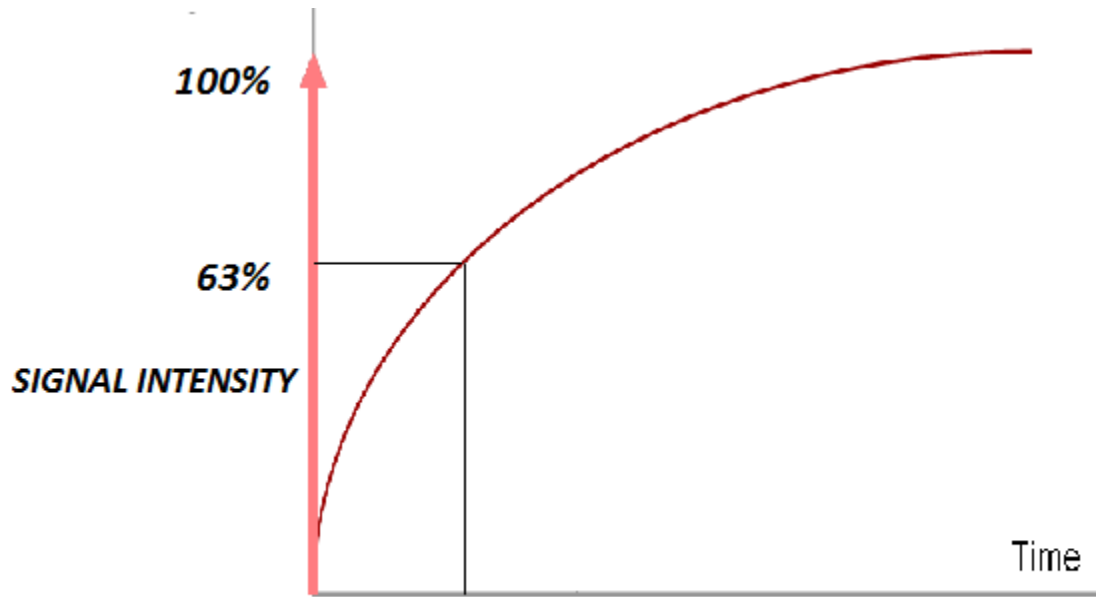
MR





- Un impulso a 90° annulla la magnetizzazione longitudinale e mette in fase i protoni, creando la magnetizzazione trasversale.
- Quando l'impulso è interrotto si recupera la magnetizzazione longitudinale e la magnetizzazione trasversale decade.

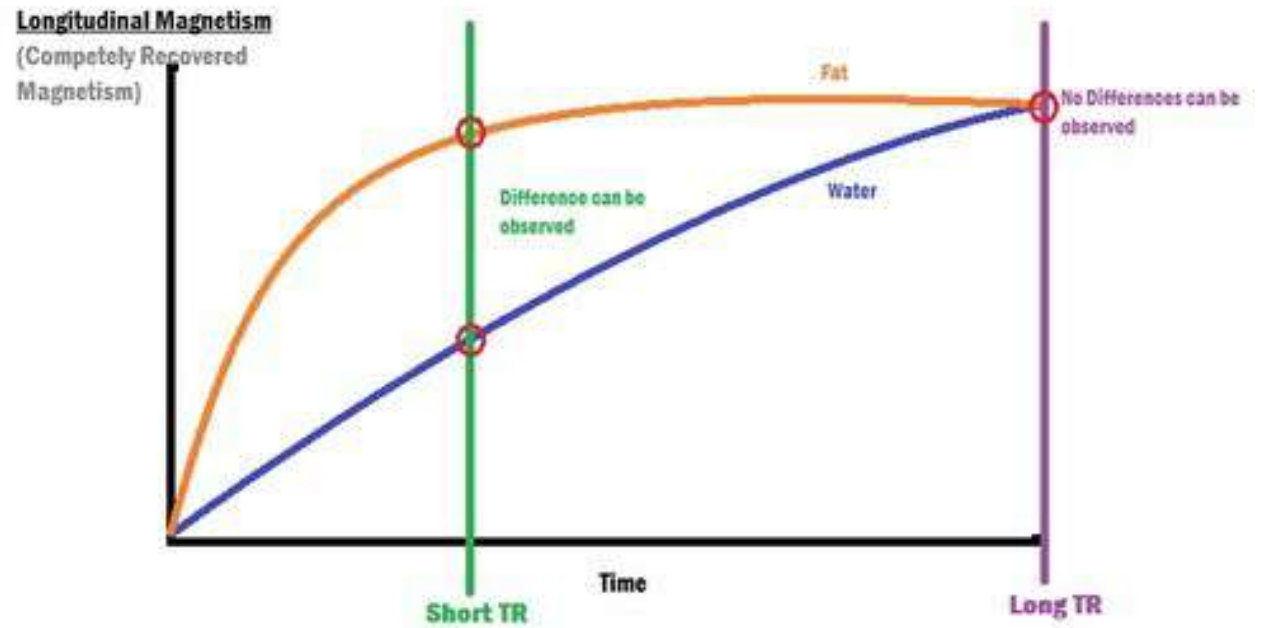
T1



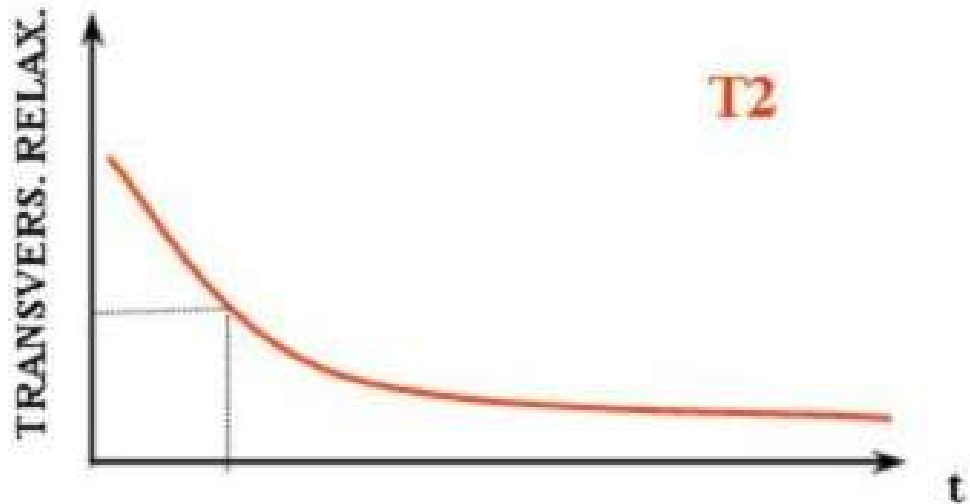
T1 RECOVERY CURVE

T1

T1 Contrast

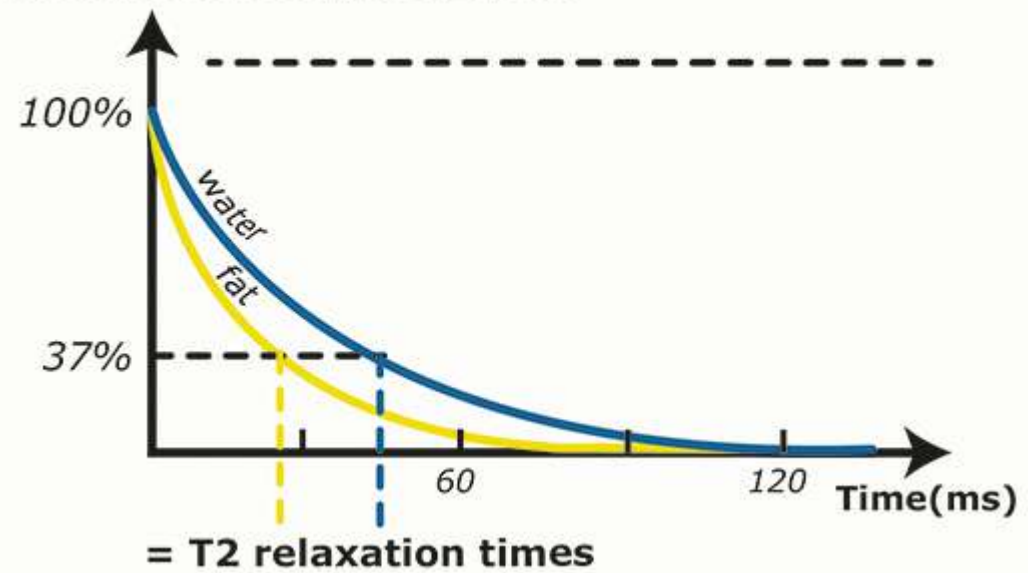


T2

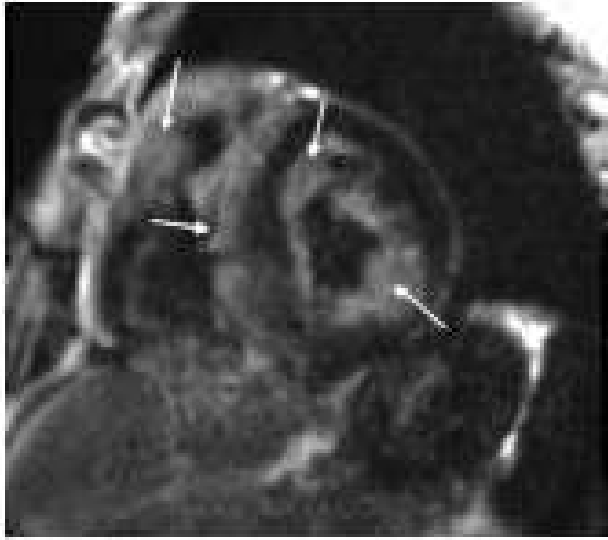


T2

Transversal magnetization



AMILOIDOSI



- HCM

- Cardiopatia Ipertensiva

- Cuore d'atleta

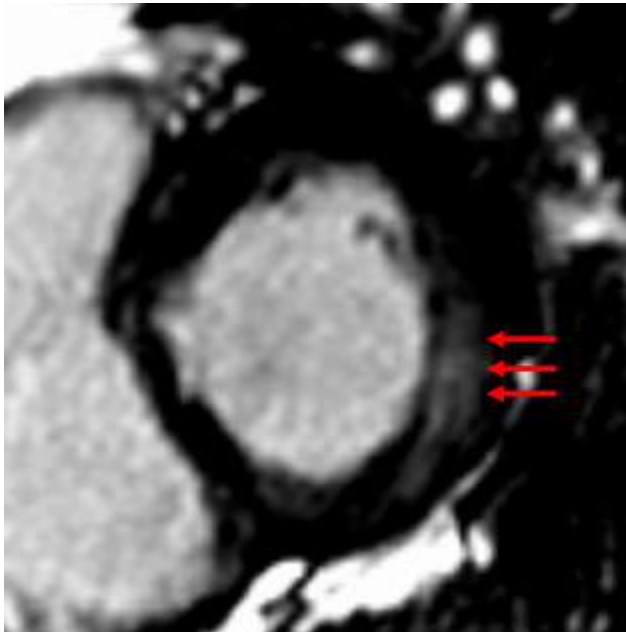
- Amiloidosi

- Glicogenosi



HCM

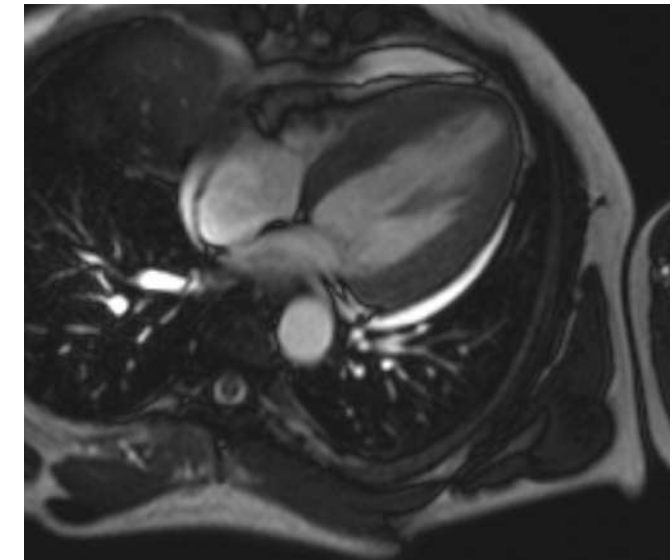
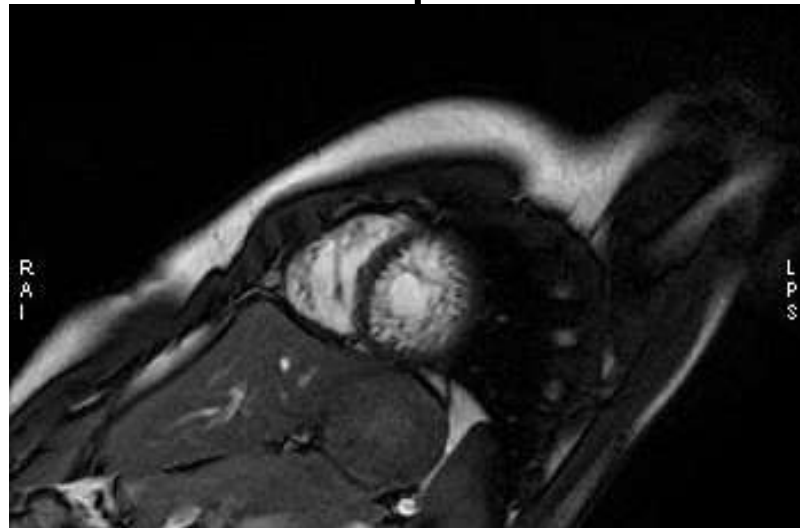
ACCUMULO



- Accumulo lisosomiale

- Non compatto

NC



CARDIOPATIA IPERTENSIVA

Subendo cardial



- Subendocardial infarction



- Transmural infarction



- Amyloidosis
- Syst sclerosis

Mid-wall



- HOCM
- Right ventr overload



- Idiopathic Dilated CM
- Myocarditis

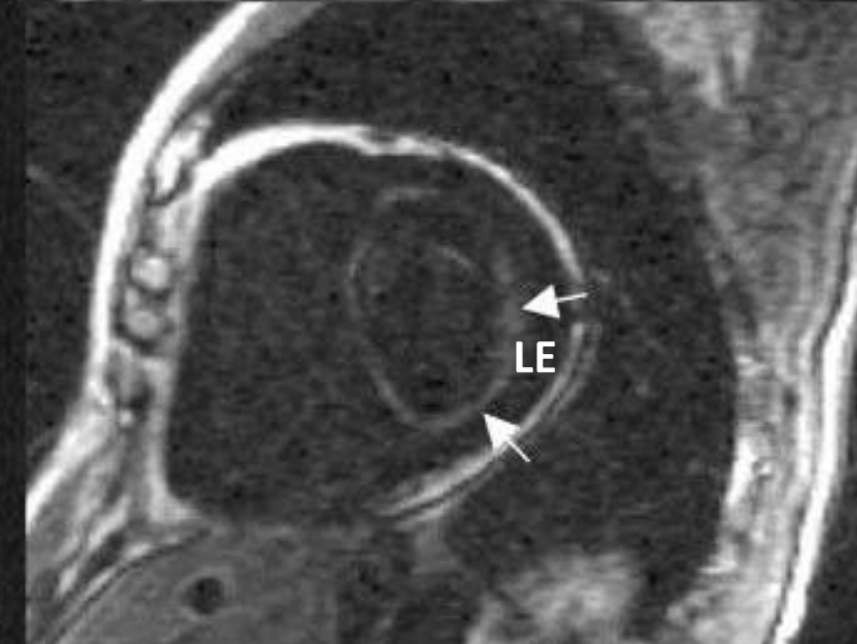
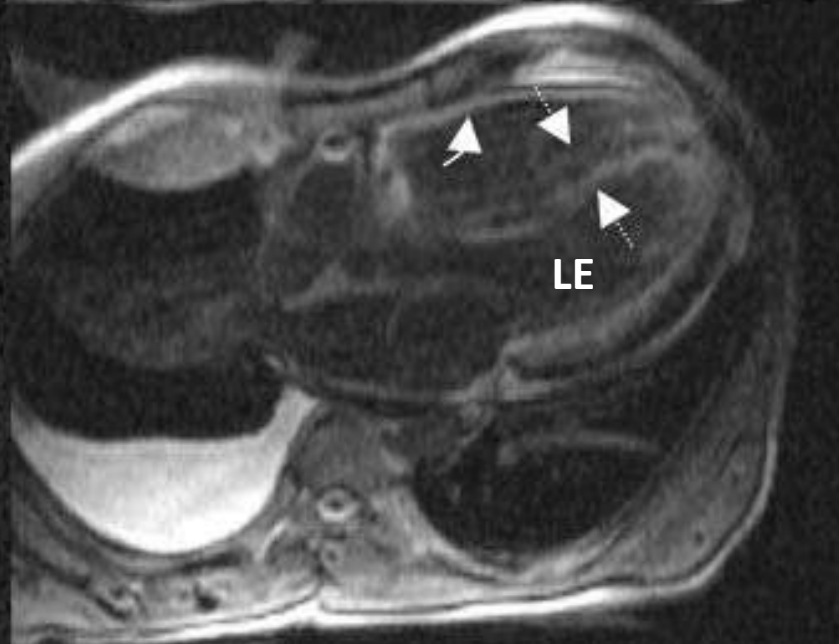
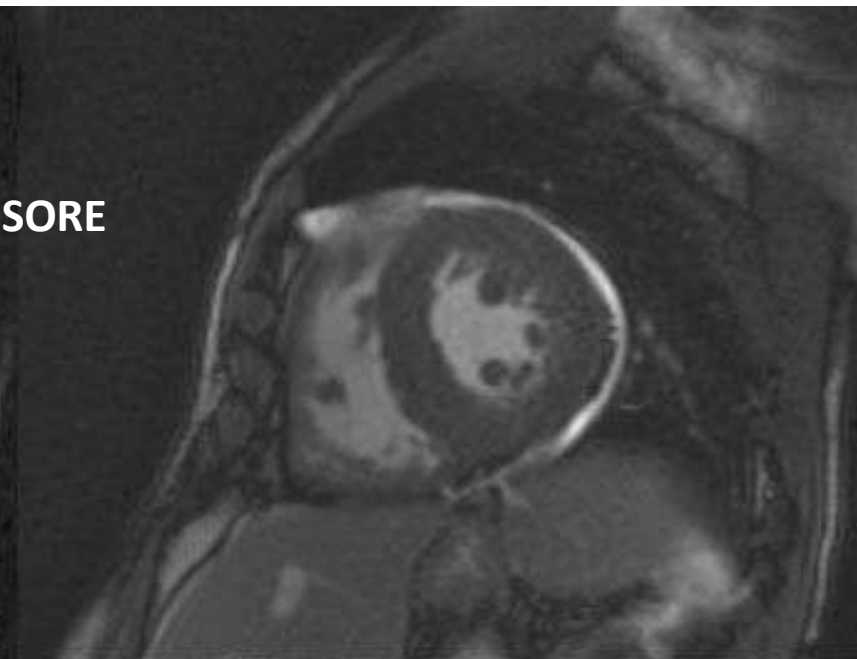
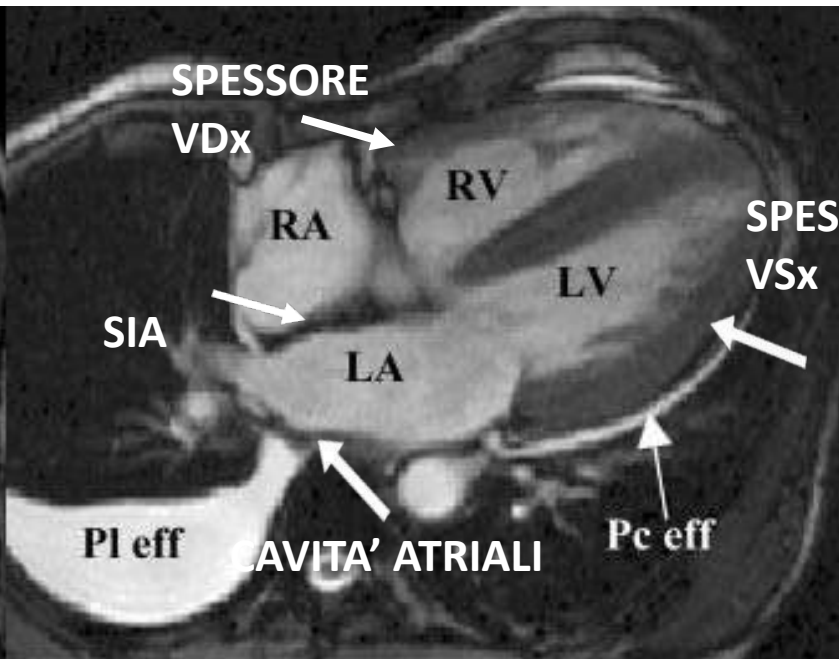
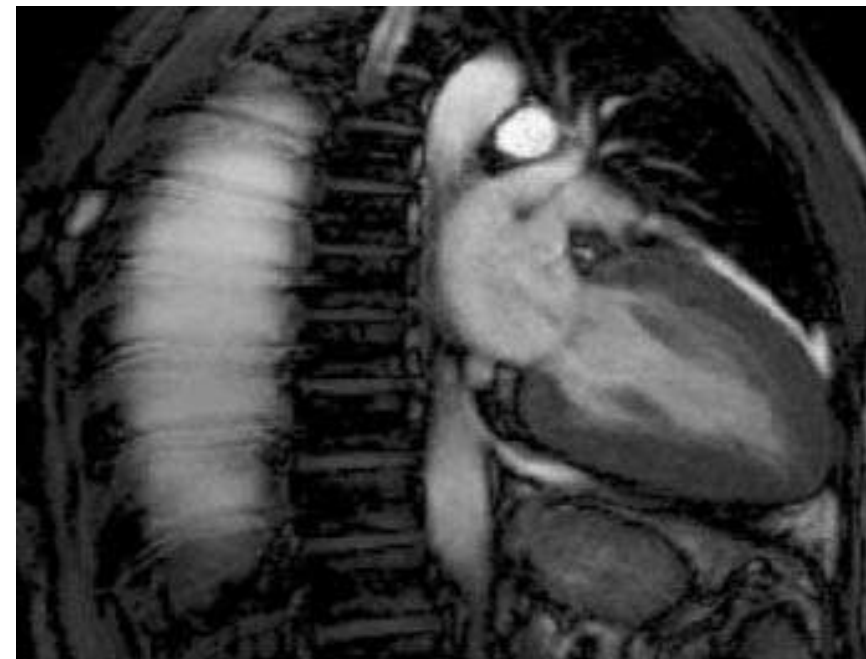


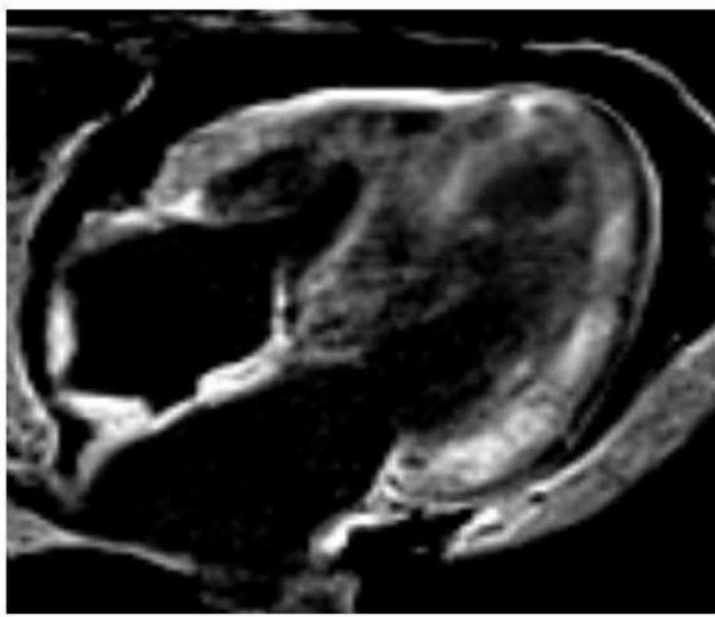
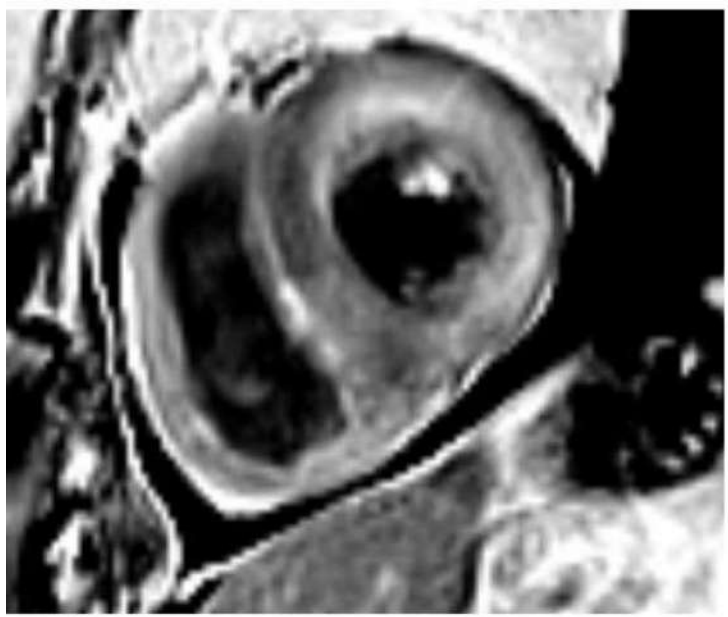
- Sarcoidosis
- Myocarditis
- Anderson-Fabry
- Chagas

Epicardial

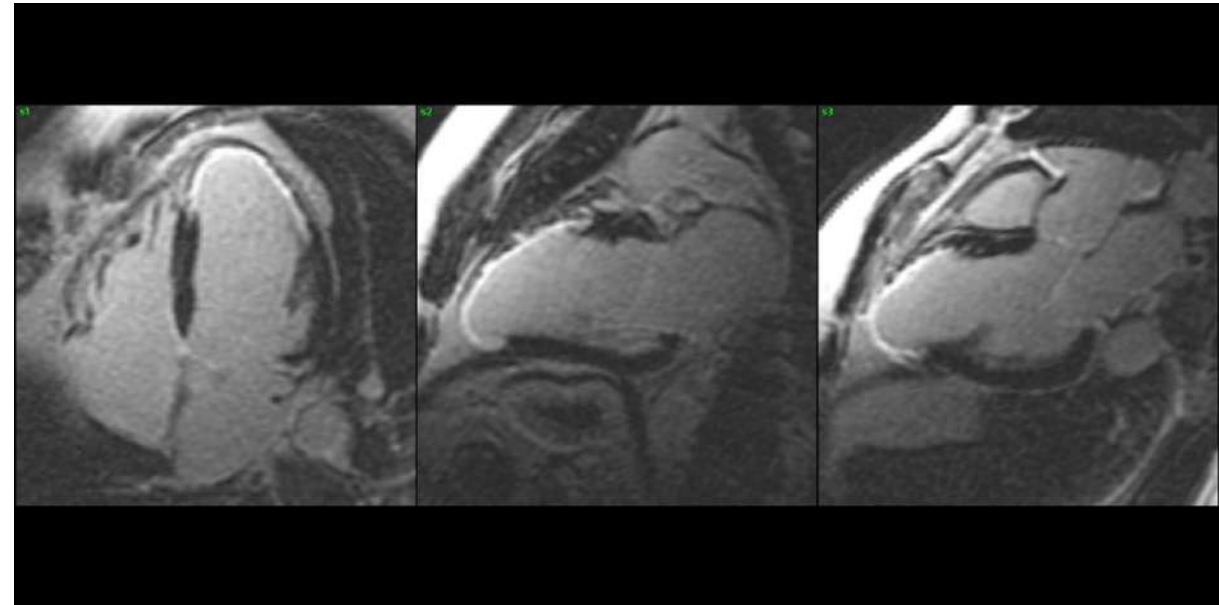
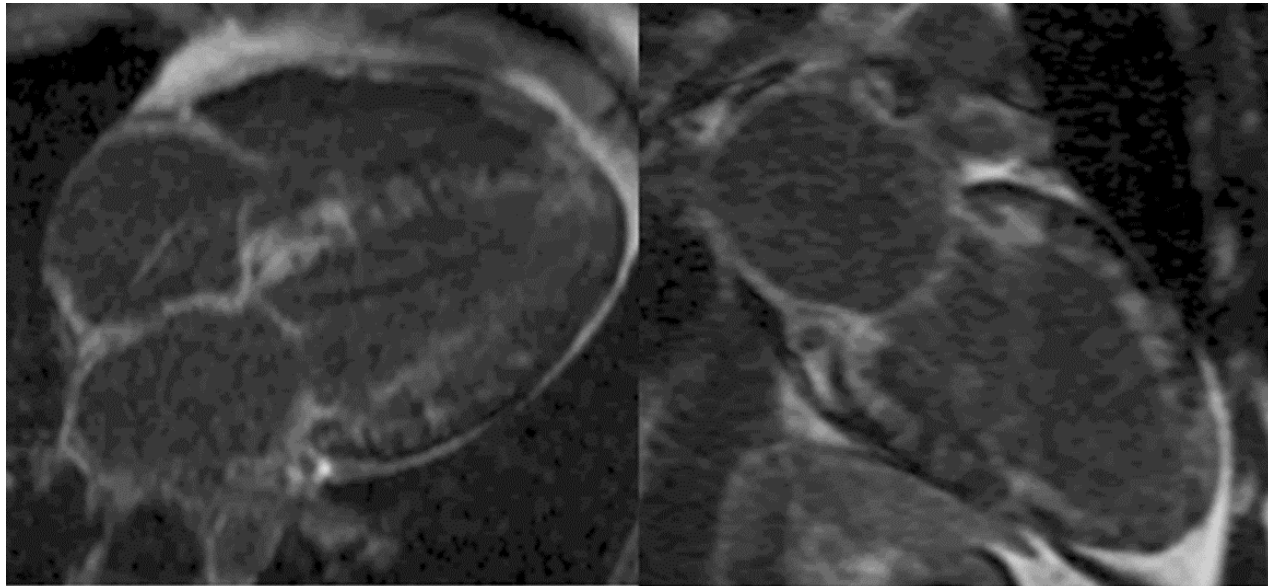


- Sarcoidosis
- Myocarditis
- Anderson-Fabry
- Chagas

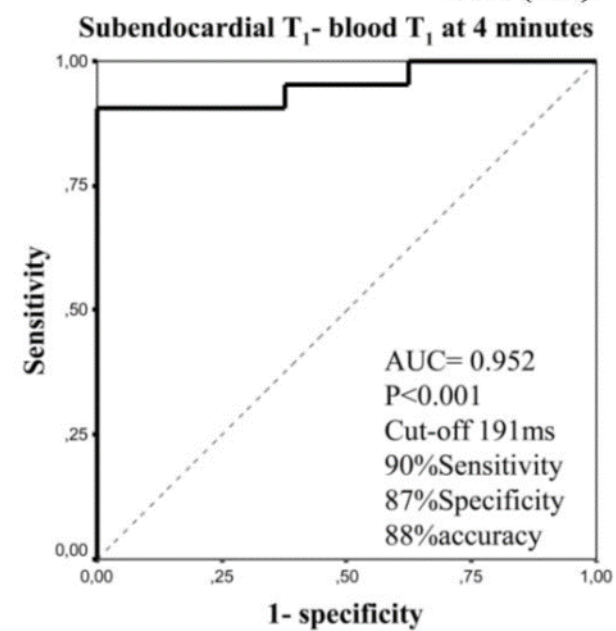
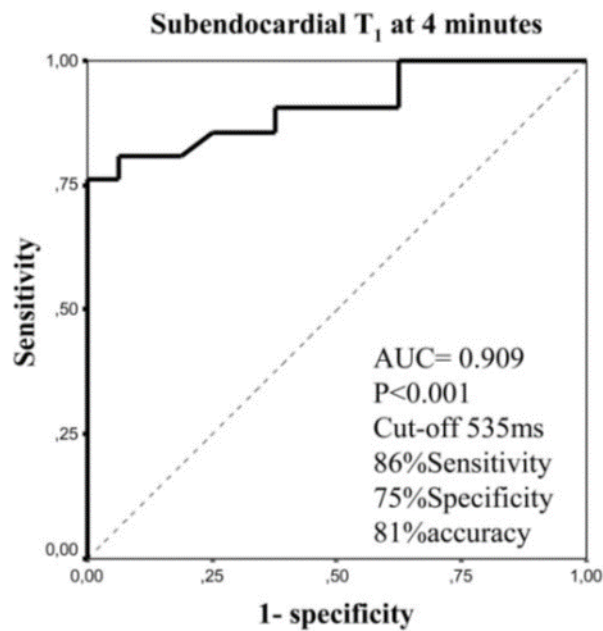
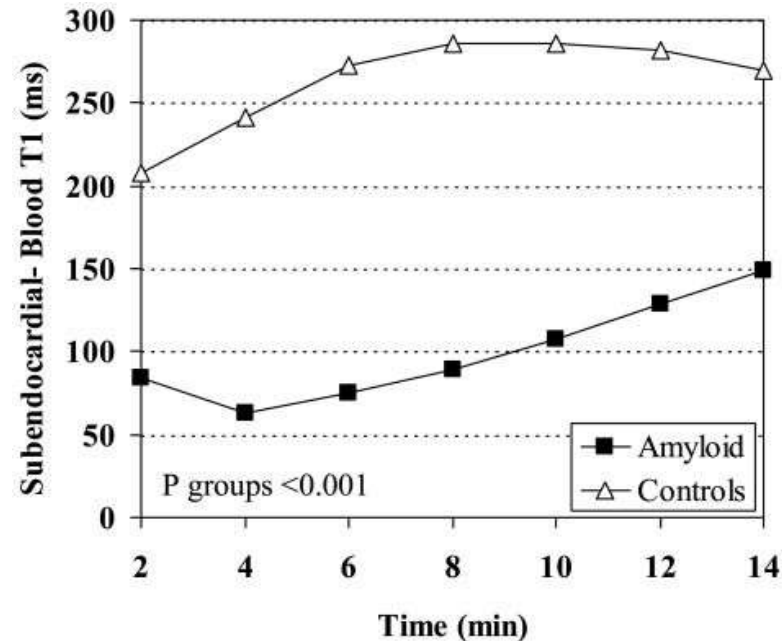
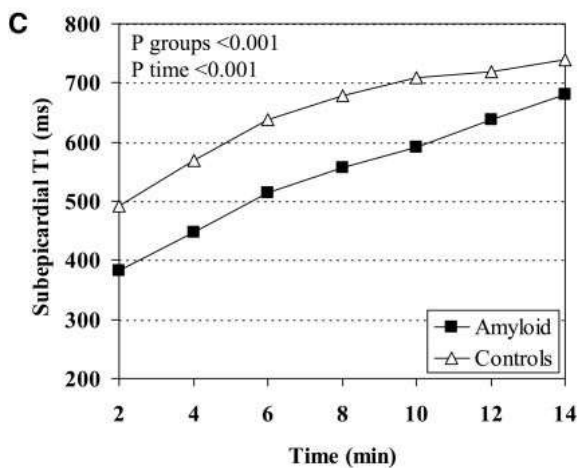
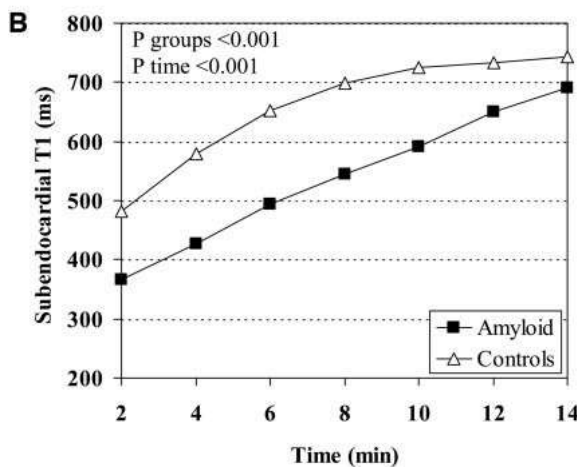
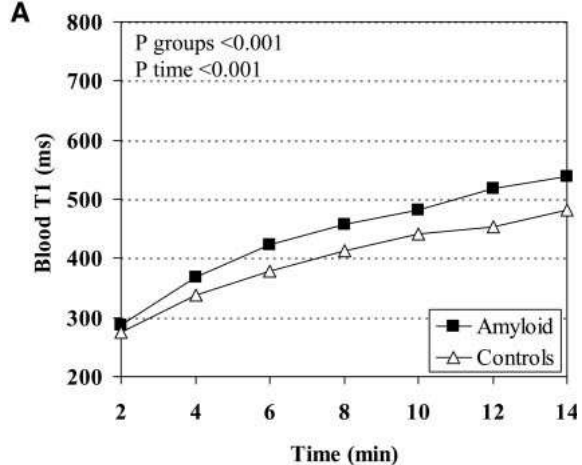




Role of cardiovascular imaging for the diagnosis and prognosis of cardiac amyloidosis Agha AM, *et al. Open Heart* 2018;



Cinetica gadolinio



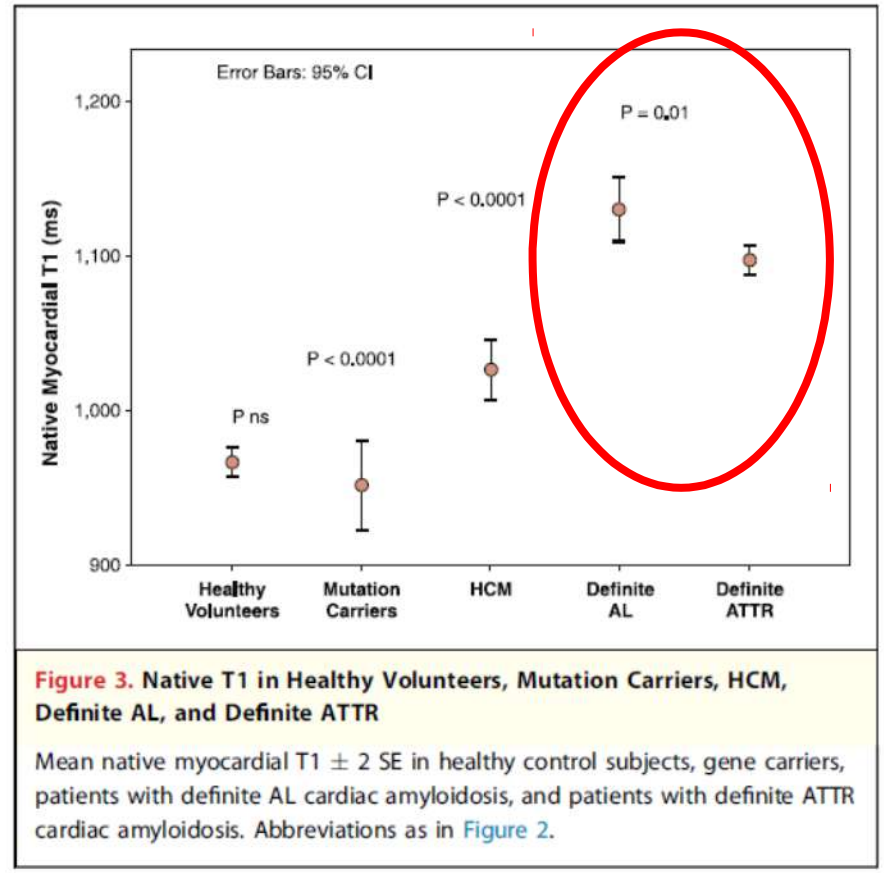
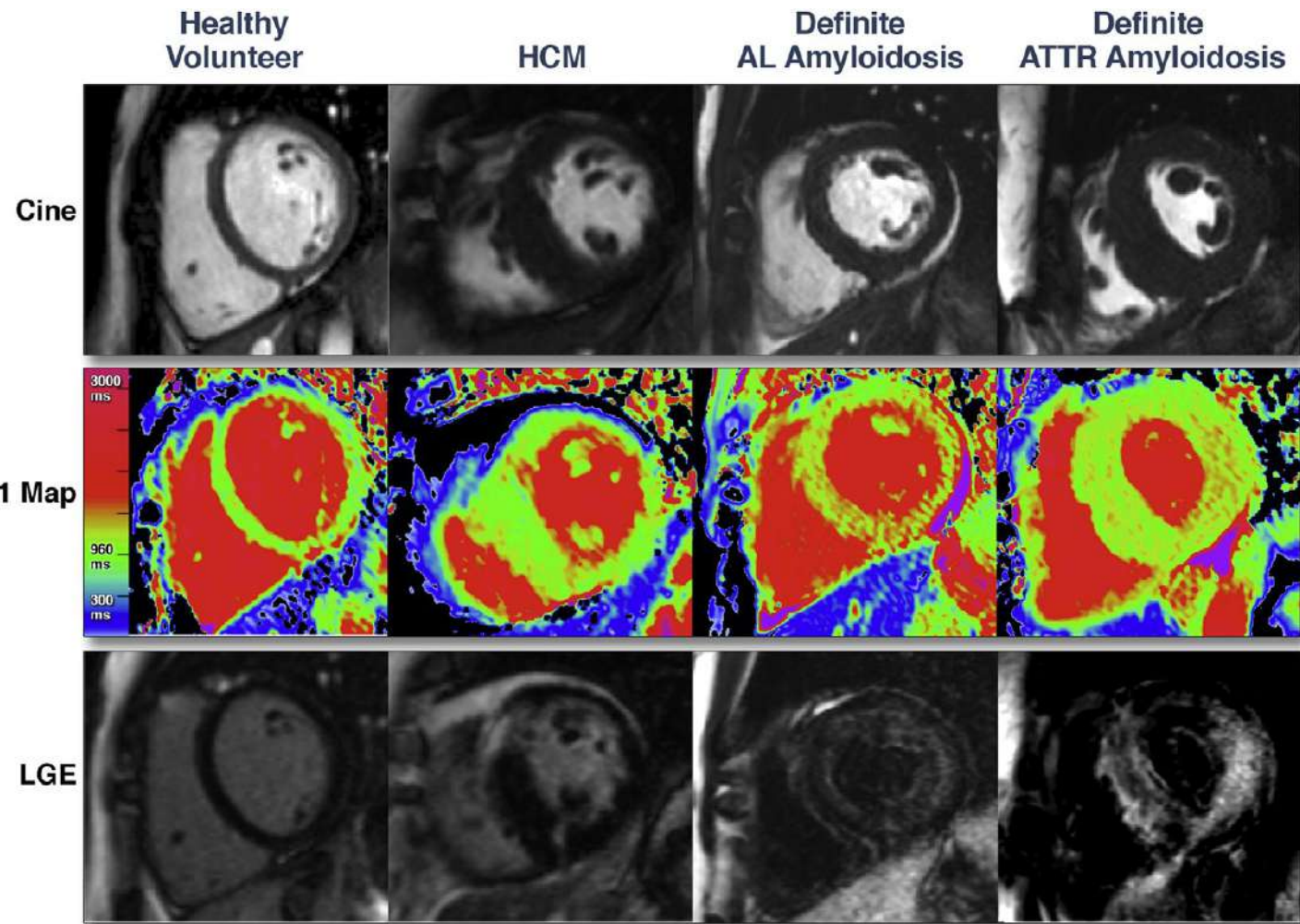


Figure 3. Native T1 in Healthy Volunteers, Mutation Carriers, HCM, Definite AL, and Definite ATTR
 Mean native myocardial T1 ± 2 SE in healthy control subjects, gene carriers, patients with definite AL cardiac amyloidosis, and patients with definite ATTR cardiac amyloidosis. Abbreviations as in Figure 2.

T1 Mapping and ECV in clinical practice

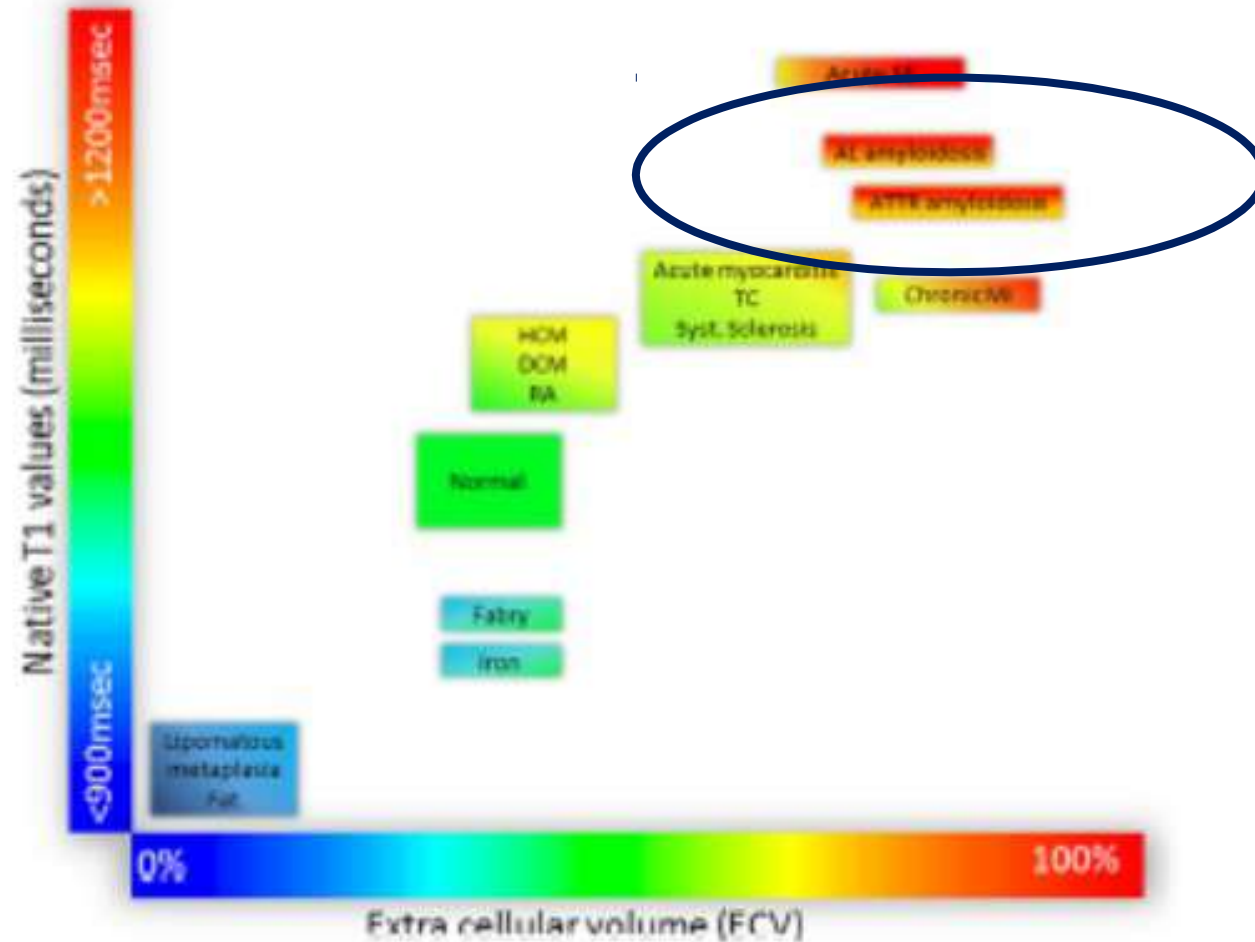
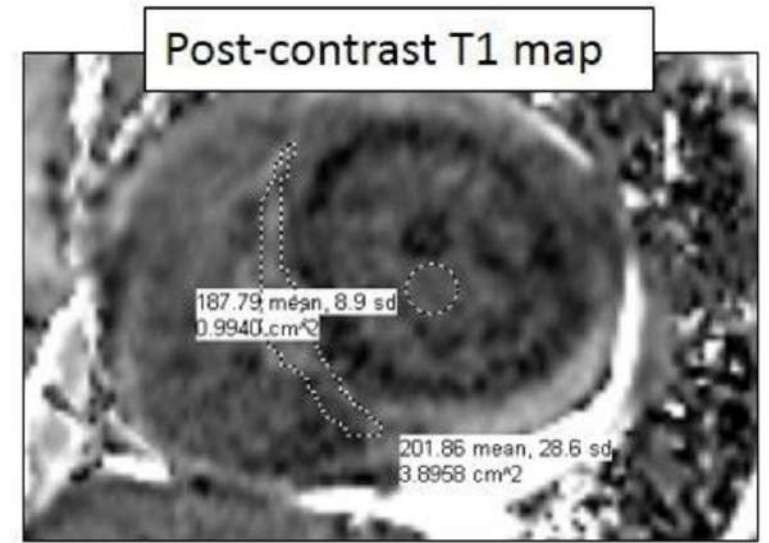
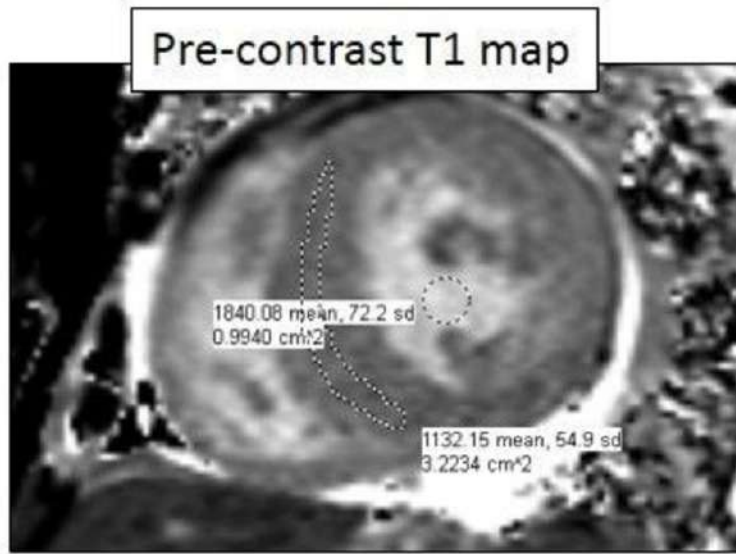


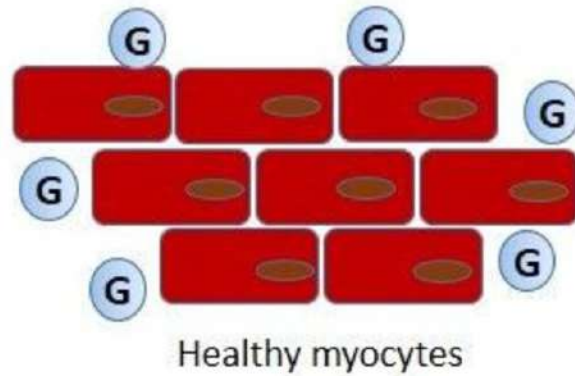
Fig. 2 Tissue characterisation using native T1 and extracellular volume fraction (ECV). Absolute values for native T1 depend greatly on field strength (1.5 T or 3 T), pulse sequence (MOLL or ShMOLL), scanner manufacturer and rules of measurements. For the purpose of comparability, only studies using 1.5 T scanners were considered in this figure. Figure adapted from Martin Ugander (SCMR 2014)



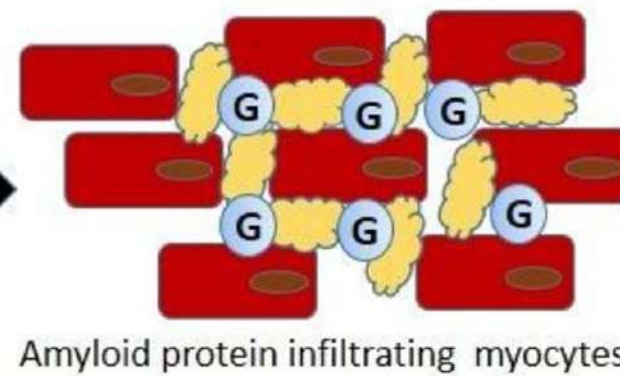
HCT:
37.5%

ECV cut off 0.45

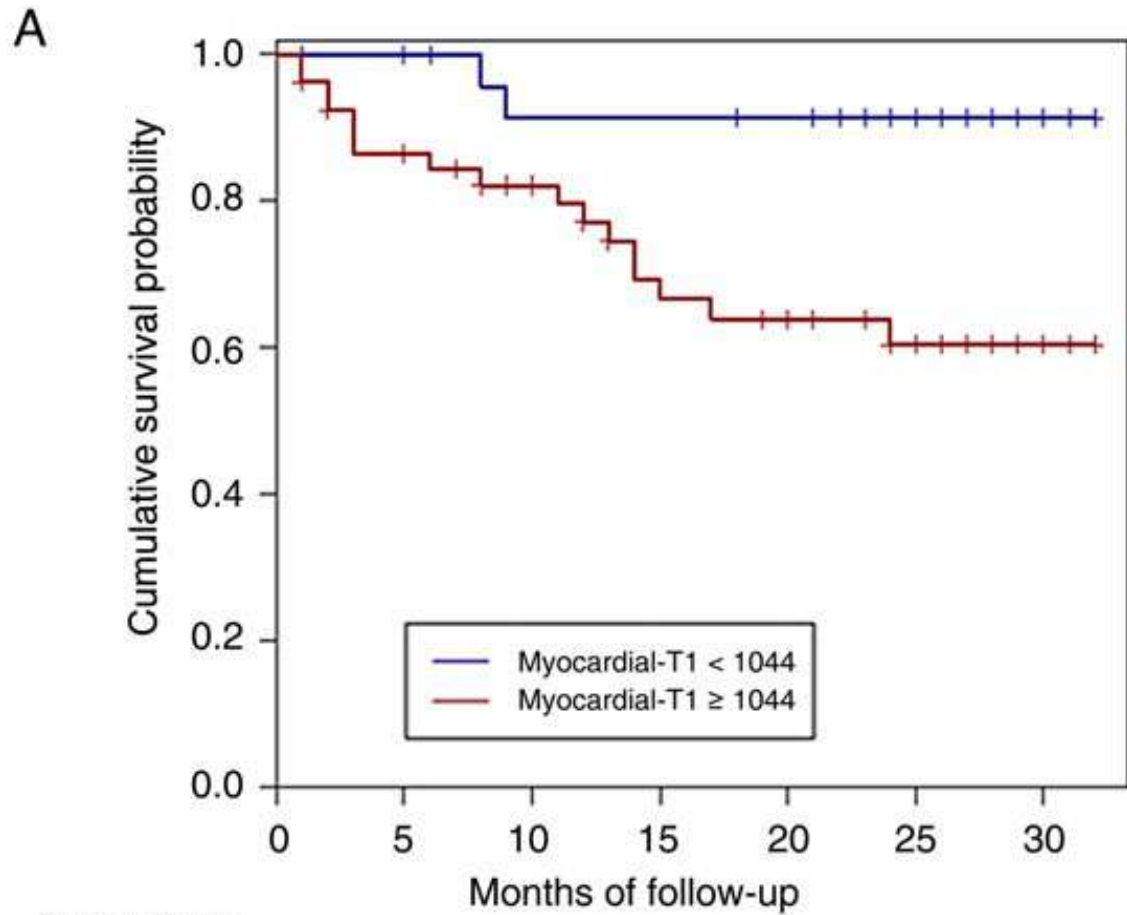
$$ECV = \frac{\frac{1}{T_{1myo\ pre}} - \frac{1}{T_{1myo\ post}}}{\frac{1}{T_{1blood\ pre}} - \frac{1}{T_{1blood\ post}}} \times (1 - HCT) = \frac{\frac{1}{1132} - \frac{1}{202}}{\frac{1}{1840} - \frac{1}{188}} \times (1 - 0.375) = 0.53$$



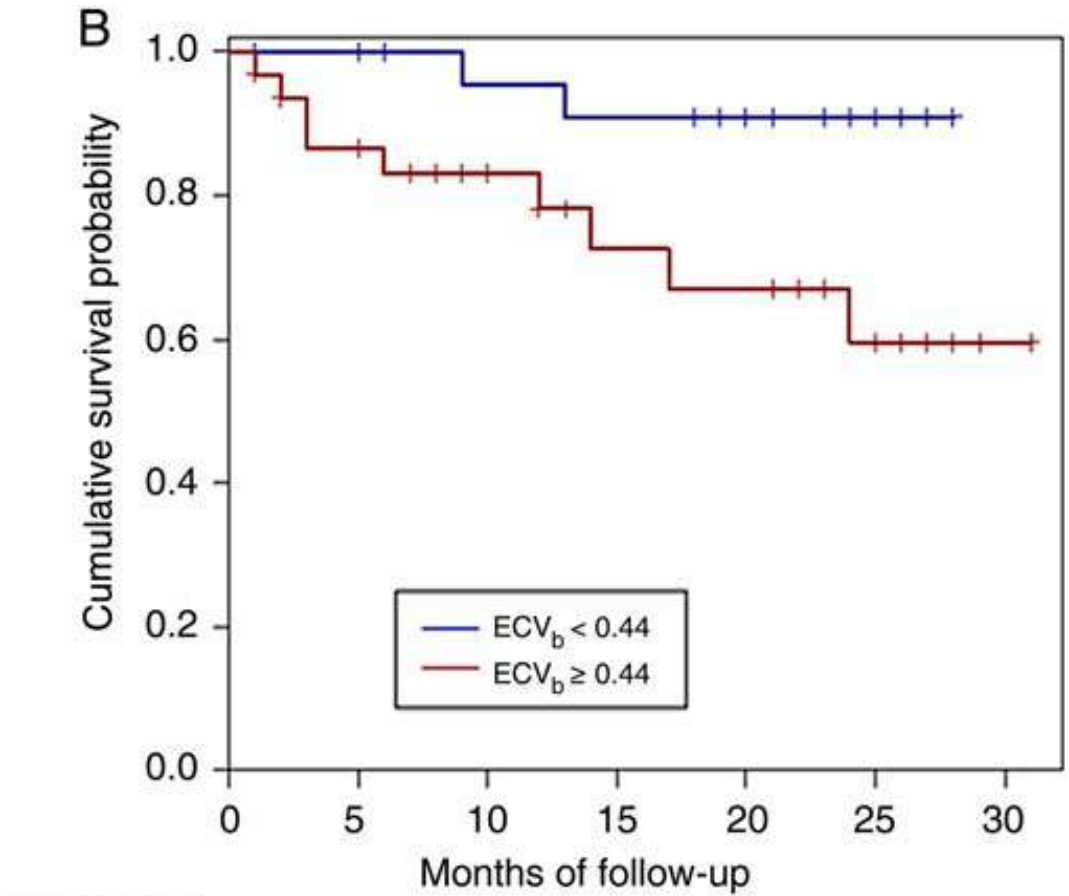
Amyloid infiltration



G Gadolinium Based Contrast Agent
Amyloid Protein



Number at risk		0	5	10	15	20	25	30
Myocardial-T1 < 1044	27	25	21	21	20	16	5	
Myocardial-T1 ≥ 1044	54	43	35	26	23	16	4	



Number at risk		0	5	10	15	20	25	30
ECV _b < 0.44	27	24	21	20	18	11	0	
ECV _b ≥ 0.44	32	25	19	13	12	8	1	

T1 mapping and survival in systemic light-chain amyloidosis
Banyersad et al. European Heart Journal 2015

openheart Role of cardiovascular imaging for the diagnosis and prognosis of cardiac amyloidosis

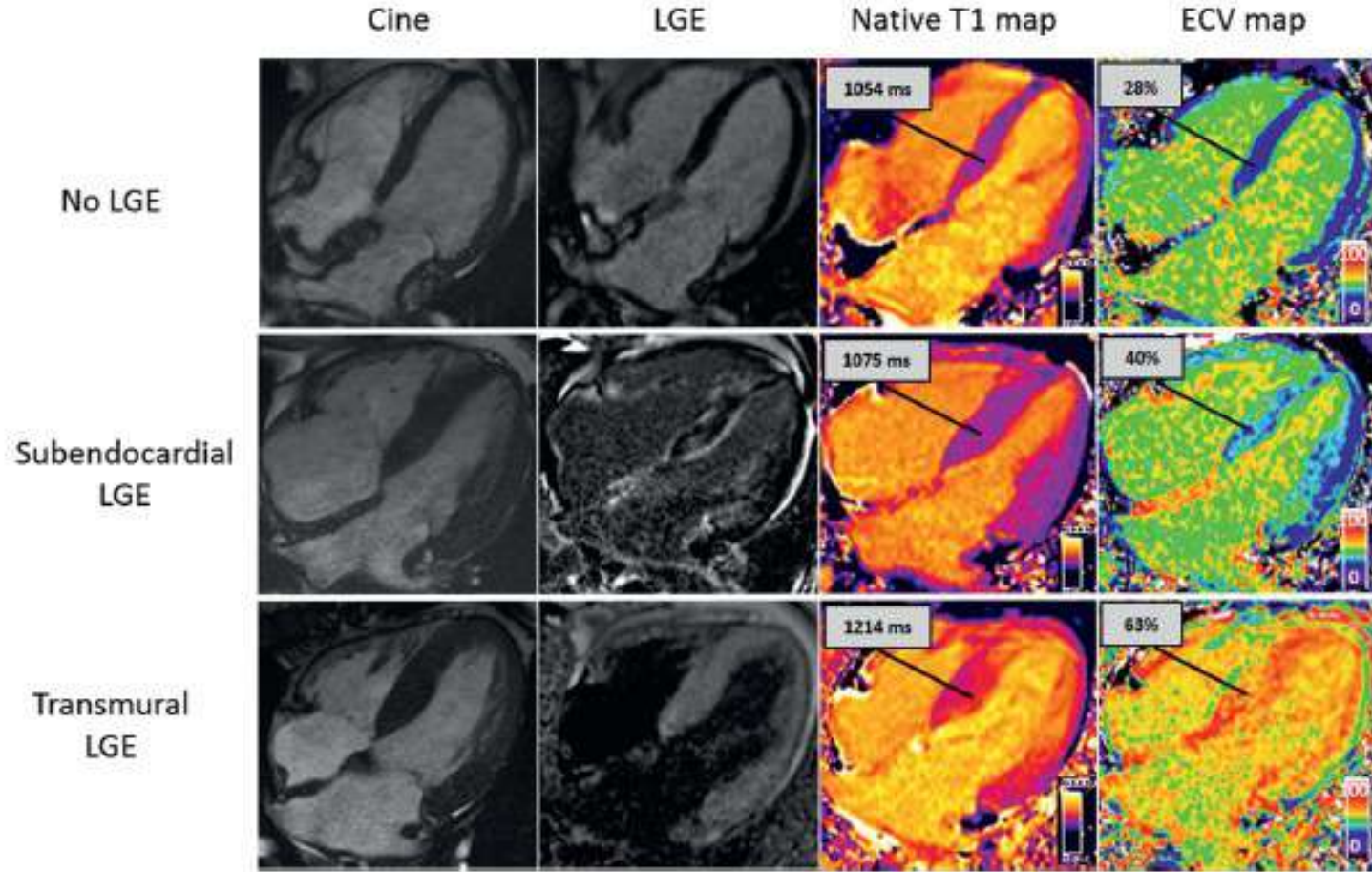
ECV correlated with echocardiographic parameters including:

- left ventricular mass
- septal thickness
- end systolic volume
- left atrial area
- N-terminal pro-BNP levels
- troponin T levels
- smaller
- QRS voltages
- poor performance with 6 min walk test

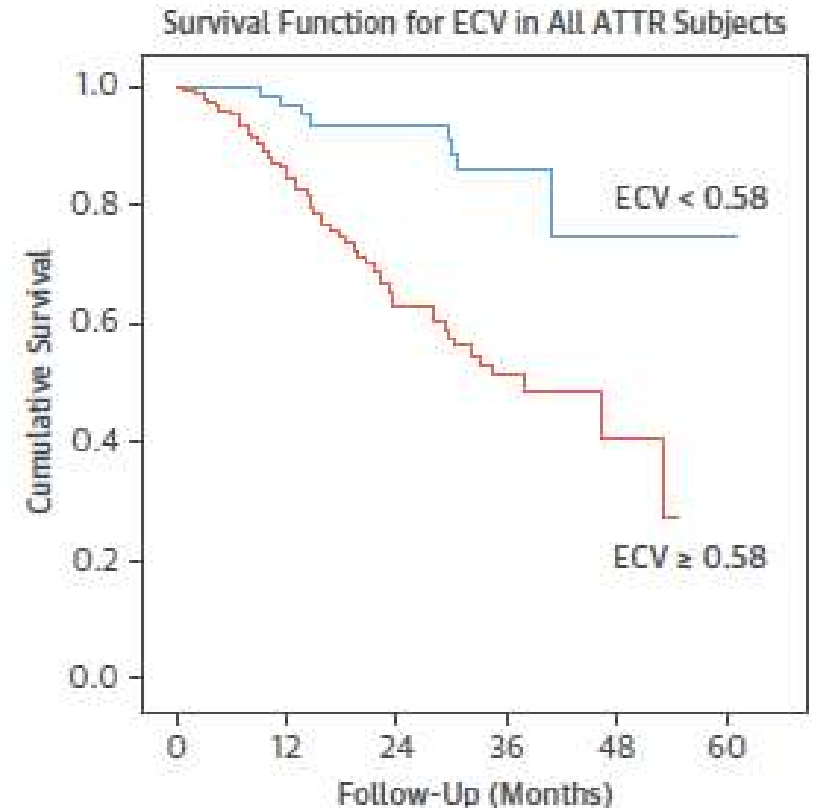
Ali M Agha,¹ Purvi Parwani,² Avirup Guha,³ Jean B Durand,⁴ Cezar A Iliescu,⁴ Saamir Hassan,⁴ Nicolas L Palaskas,⁴ Greg Gladish,⁵ Peter Y Kim,⁴ Juan Lopez-Mattei^{4,5}

Perhaps most surprisingly, ECV was also found to be increased in cases where hypertrophy was not present on echocardiography, as well as where LGE did not demonstrate evidence of amyloidosis. This implies that ECV might be a very sensitive test, which may allow for earlier detection of CA than other methods of diagnosis.

FIGURE 2 LGE Patterns Correlating With T1 and ECV Measurements

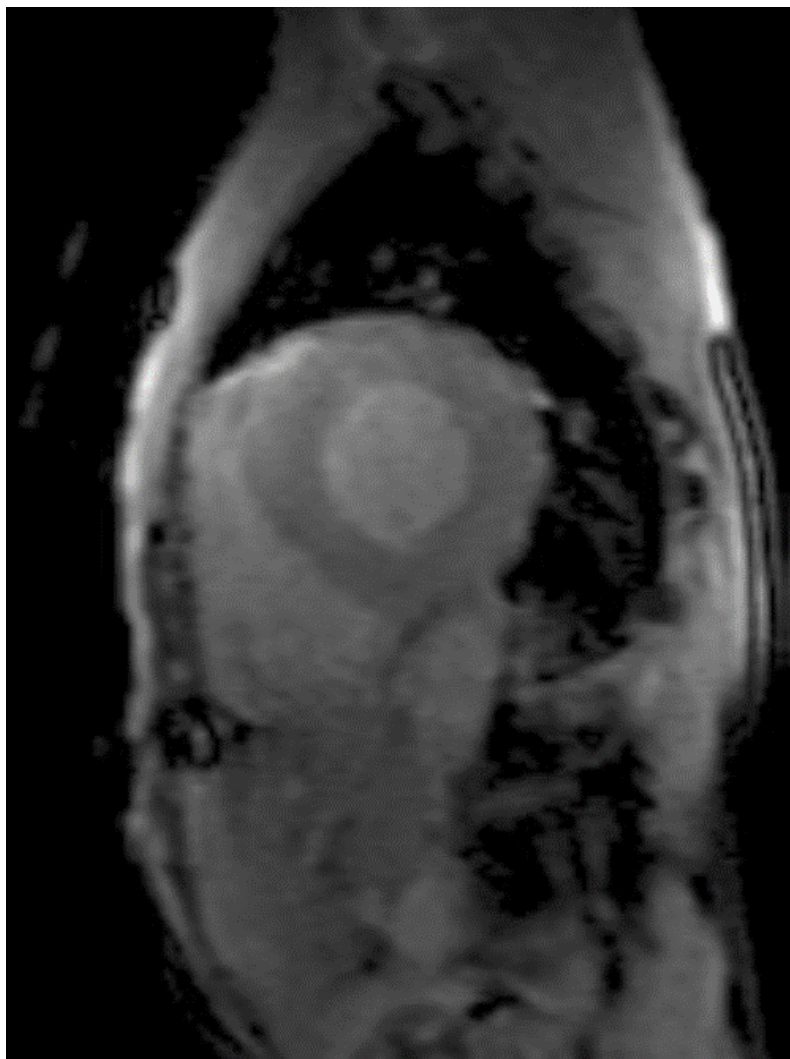


Images shown include 4-chamber cine, corresponding LGE image with phase-sensitive reconstruction, native T1 maps, and extracellular volume (ECV) maps in 3 patients with cardiac transthyretin amyloidosis. The patient with no LGE has normal native T1 and ECV maps; the patient with subendocardial LGE had borderline T1 values and high ECV values; and in the patient with transmural LGE, very high native T1 values and very high ECV values were seen. Abbreviations as in [Figure 1](#).

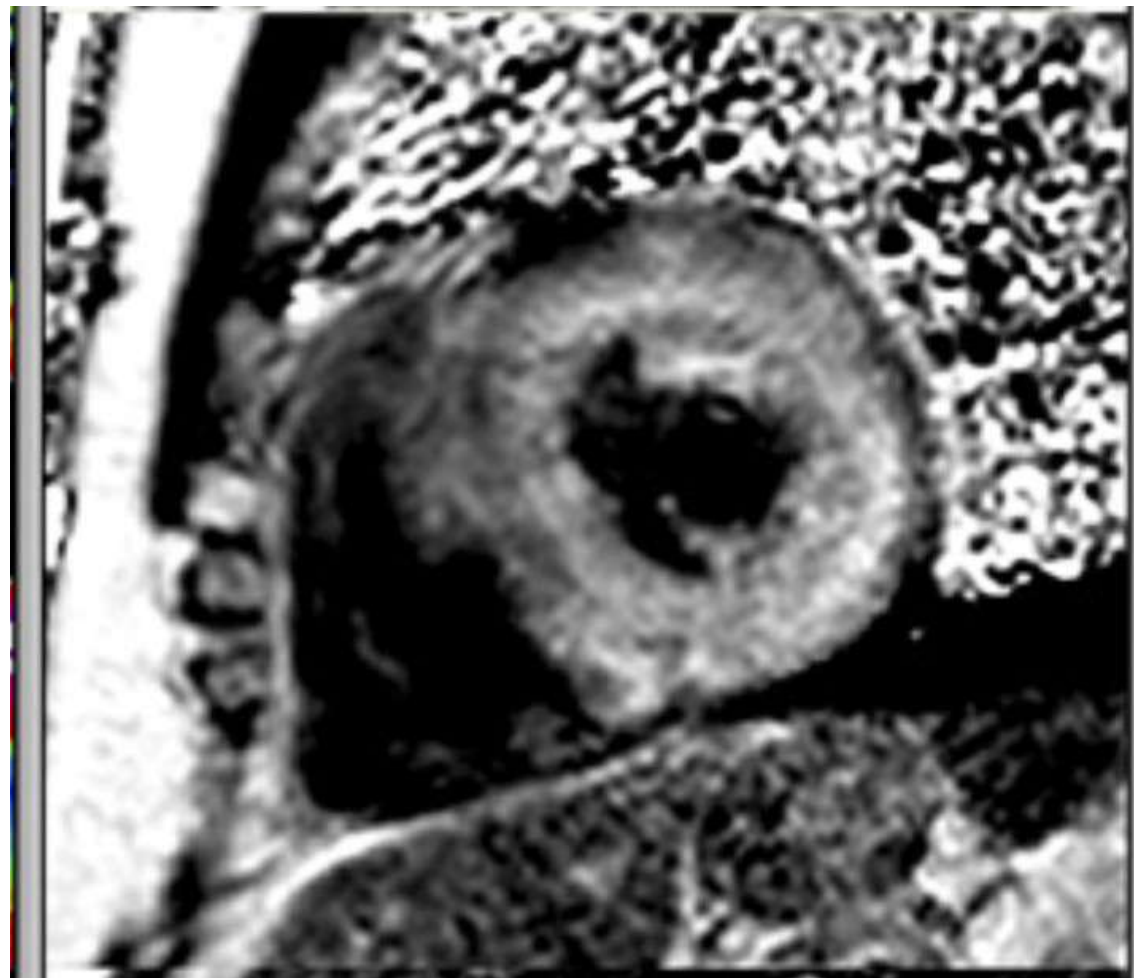


CERCANDO L'AMILOIDE: IL PRESENTE

NO NULL

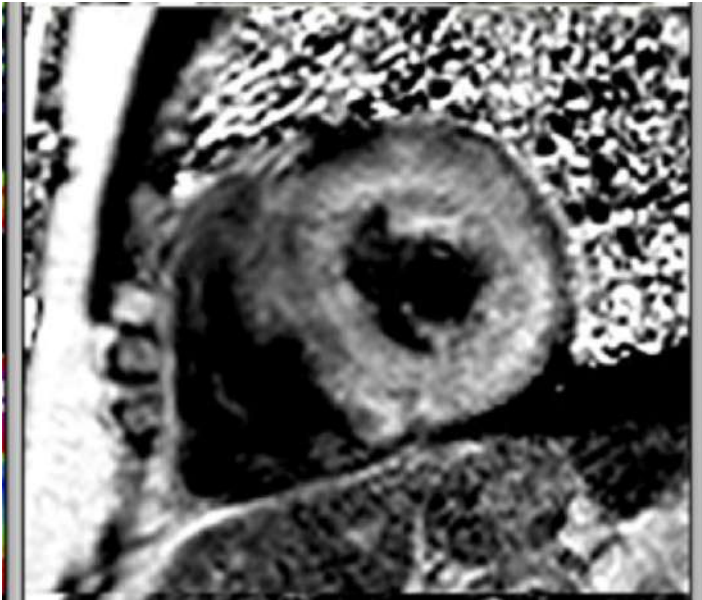
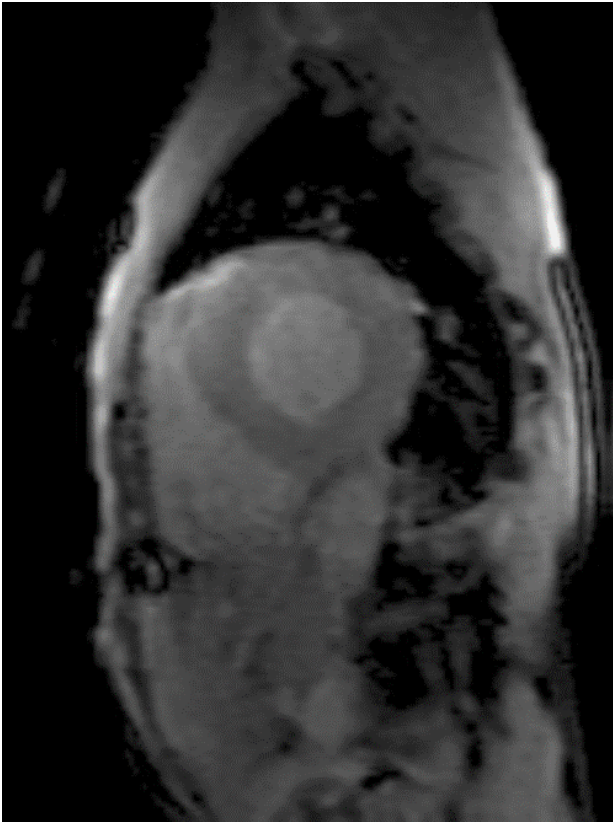


LE

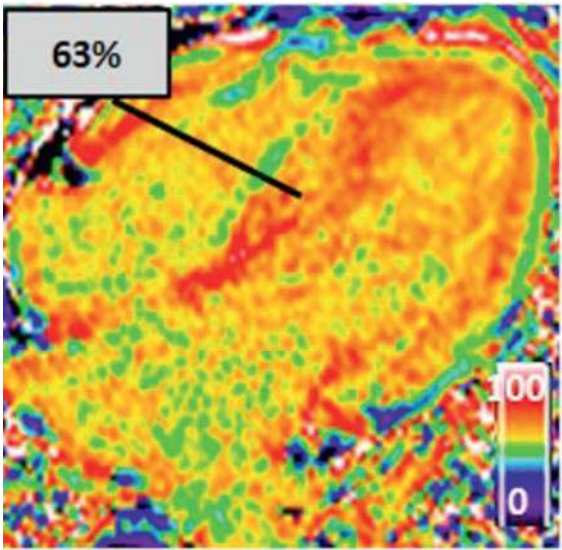


CERCANDO L'AMILOIDE: IL FUTURO

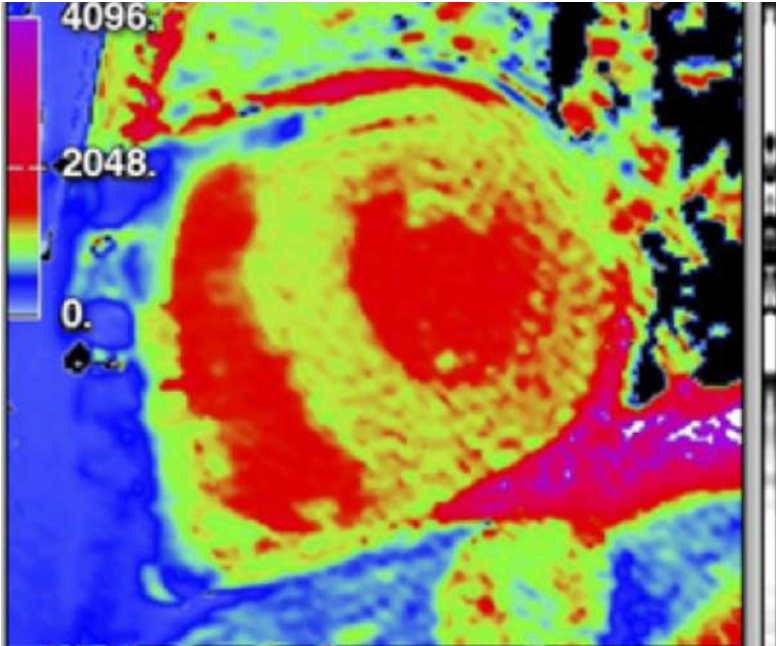
NO NULL



LE



ECV



T1 NATIVE