

What is the Clinical Value of Quantitative Myocardial Tissue Characterization?

Prof. Jeanette Schulz-Menger

Working Group Cardiac MRI, Charité University Medicine Berlin, Experimental and Clinical Research Center,
Cardiology and HELIOS Clinics-Berlin, Clinic for Cardiology and Nephrology

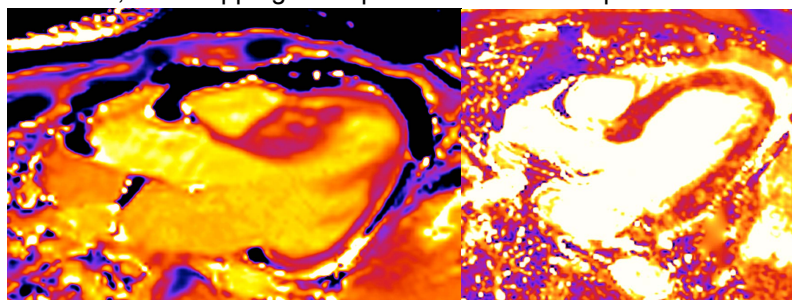
Email jeanette.schulz-menger@charite.de

Cardiovascular MR (CMR) allows not only an accurate quantification of cardiac function, but also myocardial tissue differentiation. This reflects unique capabilities of CMR in comparison to other noninvasive imaging modalities. Currently, CMR is playing a growing role in guidelines for patient routine care. Tissue characterization does not only play a major role in Coronary Artery Disease, but also in other entities e.g. in cardiomyopathies including myocardial involvement in systemic disorders. Especially in inflammatory disorder CMR has unique capability to detect the potential myocardial injury already in preserved ejection fraction. Currently the imaging protocols are based on semi-quantitative and visual assessment of contrast- and non-contrast enhanced techniques. Those combined sequences allow the differentiation between reversible and irreversible injury, in ischemic and non-ischemic heart disease.

Parametric mapping seems to offer new insights and more than that, it is opening the door to quantification. Quantification is a one of the basic prerequisites for an accurate follow-up to guide therapies.

The introduction of T2* quantification in patients with iron overload led to a significant reduction of mortality in this entity in UK. The reason was the identification of increased myocardial iron content in preserved ejection fraction. This work is based on a systematic evaluation of the techniques from phantom to patient led by Dudley Pennel (Brompton, London UK).¹ In 2004 Messroghli et al introduced a new T1-mapping "MOLLI". Meanwhile a large number of different T1-mapping techniques were and are introduced. The development of new hard- and software resulted in higher spatial resolution. A clinical application depends on a high reproducibility and accuracy. Currently, several groups are working on standardization and on the development of normal values.^{2, 3} First results in patients with myocarditis are promising, but the results in differentiation of left ventricular hypertrophy are groundbreaking.⁴

If the techniques themselves will allow the quantification of thin myocardial structures with unregularly motion, one would assume, that mapping will replace current techniques.



Modell B, Khan M, Darlison M, Westwood MA, Ingram D and Pennell DJ. Improved survival of thalassaemia major in the UK and relation to T2* cardiovascular magnetic resonance. *Journal of cardiovascular magnetic resonance : official journal of the Society for Cardiovascular Magnetic Resonance*. 2008;10:42.

von Knobelsdorff-Brenkenhoff F, Prothmann M, Dieringer MA, Wassmuth R, Greiser A, Schwenke C, Niendorf T and Schulz-Menger J. Myocardial T1 and T2 mapping at 3 T: reference values, influencing factors and implications. *Journal of cardiovascular magnetic resonance : official journal of the Society for Cardiovascular Magnetic Resonance*. 2013;15:53.

Moon JC, Messroghli DR, Kellman P, Piechnik SK, Robson MD, Ugander M, Gatehouse PD, Arai AE, Friedrich MG, Neubauer S, Schulz-Menger J and Schelbert EB. Myocardial T1 mapping and extracellular volume quantification: a Society for Cardiovascular Magnetic Resonance (SCMR) and CMR Working Group of the European Society of Cardiology consensus statement. *Journal of cardiovascular magnetic resonance : official journal of the Society for Cardiovascular Magnetic Resonance*. 2013;15:92.

Sado DM, White SK, Piechnik SK, Banyersad SM, Treibel T, Captur G, Fontana M, Maestrini V, Flett AS, Robson MD, Lachmann RH, Murphy E, Mehta A, Hughes D, Neubauer S, Elliott PM and Moon JC. Identification and assessment of Anderson-Fabry disease by cardiovascular magnetic resonance noncontrast myocardial T1 mapping. *Circ Cardiovasc Imaging*. 2013;6:392-8.

