Journal of Cardiovascular Magnetic Resonance

Myocardial T1 and ECV mapping: how we optimise technical aspects of acquisition

Ricardo Wage[*], Peter Gatehouse, Nur Hayati Jasmin, Dudley J Pennell

Background

MOLLI techniques for the acquisition of T1 maps in the heart are becoming routine practice at many centres. A wide range of techniques and scanning protocols exist in order to produce reproducible and accurate T1 maps [review in Radiographics, consensus paper James Moon]. However, familiarity and experience using these protocols may be limited outside dedicated CMR units.

Our aim is to present practical experience with a specific T1/ECV scanning protocol. We do not intend to suggest that this or any other protocol is the "correct" one, as this is subject to much ongoing investigation.

Methods

This work is based on the Siemens prototype WIP 448B and its default protocols for 11 heartbeat variants of MOLLI that have been optimized for typical pre-Gad and post-Gad ranges of T1 values. We present a mixture of experience at 1.5T and 3T.

Step 1 : Retrospective-gated TruFISP 2D cine of the Mid-LV sax. The retro-gating is quite important in this application to see the diastolic pause in full.

Step 2: By viewing the cine with the trigger-time of each frame, find the LV mid-diastolic timing in milliseconds after R-wave trigger, it may be beneficial to optimise timings for septal stability.

Step 3 : Select the T1 mapping protocol optimised for longer T1 values pre-Gad. If diastolic pause is short, select a lower-resolution version which has a shorter shot duration. Adjust MOLLI acquisition timing to match image acquisition into the middle of the diastolic pause.

Step 4: Set the "adjustments volume" (green box) over the LV (approx 12 × 12 × 12 cm cube). [on VB17 this is normally only a reference frequency adjust not a cardiac shim, use only cardiac shim if available. The "standard"

Figure 1
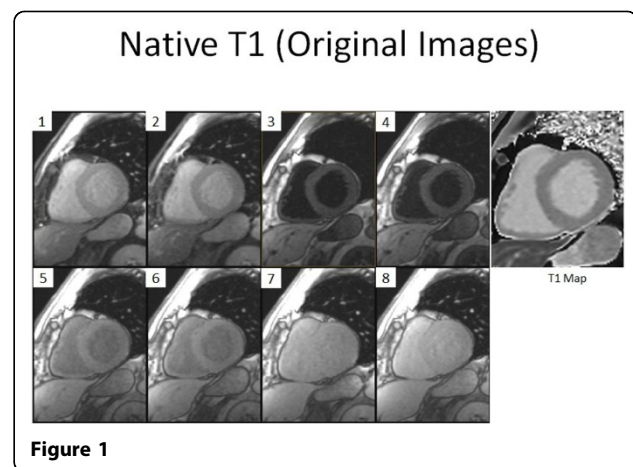
*or "advanced" Siemens shim modes are unreliable for cardiac work.*

Step 5: Acquire the MOLLI image in Breath-hold 11 cardiac cycles. Monitor ECG during this scan and record any abnormal cardiac cycles or triggers.

Step 6: Image review: This should be performed rigorously during scanning in case re-acquisition is necessary.

Step 7: For Post Contrast study after 14-15 mins of injection.(with altered T1mapping protocol for improved precision in the short-T1 range expected post-Gad). Ensure slice location and timing of shot acquisition are consistent with pre-Gad and post Gad.

Results

A detailed presentation of one centre's experience with T1/ECV mapping in a variety of challenging patients. Particular emphasis is placed on acquisition as a major pitfall exists that a T1Map is automatically generated from any input images but should be avoided for T1 measurements without reviewing the underlying image quality.

Royal Brompton Hospital, London, United Kingdom

BioMed Central

Figure 2
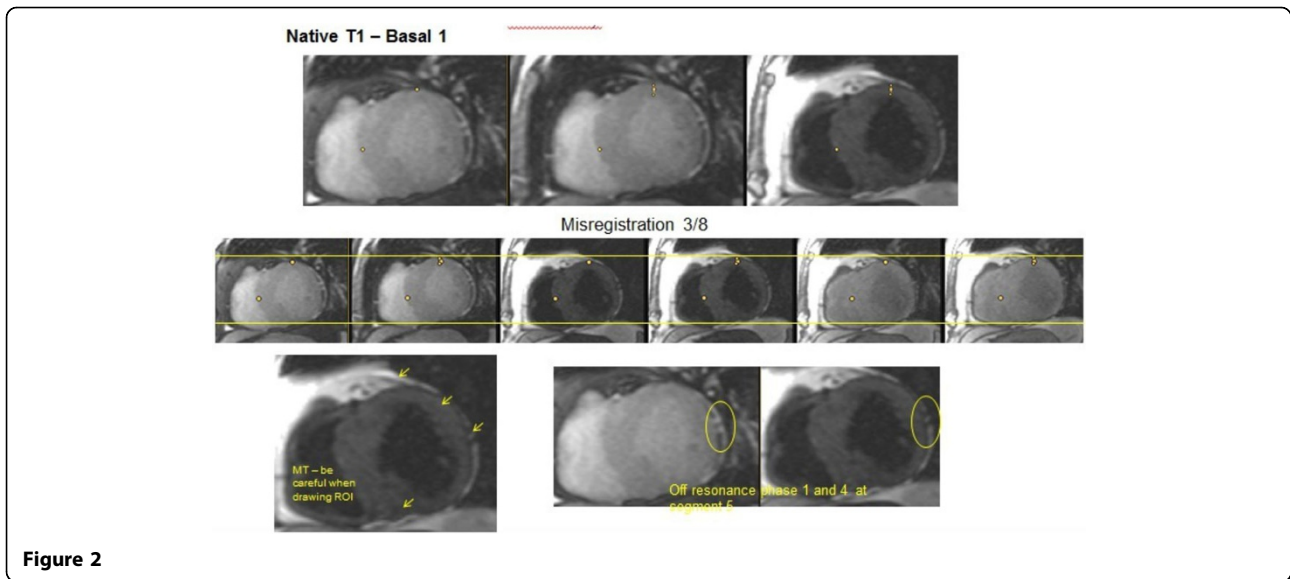
Conclusions

Familiarity and experience with T1 Mapping may be limited outside of high volume CMR units. Detailed practical guidance to minimize the number of non-diagnostic scans may reduce the "scatter" in T1 and ECV measurements, which is currently of large concern for applying these techniques.

Published: 27 January 2016