

Normal myocardial T1 values in children using a saturation and an inversion recovery sequence

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Objectives: T1 mapping by cardiac magnetic resonance (CMR) allows detection of diffuse myocardial processes such as fibrosis, edema, storage disorders, or hemochromatosis. MOLLI is a widely used inversion recovery sequence that measures T1*, which is then mathematically converted into T1 values. Smart1Map is a new saturation recovery sequence that measures T1 directly. Our aim was to establish normal values for Smart1Map in children and to compare them to MOLLI.

Methods: Twenty-nine children between 8 and 18 years of age (14 males) without evidence of cardiovascular diseases prospectively underwent CMR on a 1.5T GE scanner. Ventricular volumes and function were assessed by SSFP cine, and T1 values assessed with MOLLI and Smart1Map sequences. T1 values of myocardium and blood were determined from the resultant maps in three short-axis slices (basal, mid-ventricular, apical) using QMap (MEDIS, Leiden, NL). A region of interest was defined in the interventricular septum of each slice.

Results: In all slices, T1 values were higher by Smart1Map than by MOLLI (Table 1). Significant differences in myocardial and blood T1 values were observed between different slices by MOLLI (myocardium $p < 0.001$; blood $p < 0.05$), but not by Smart1Map (myocardium $p = 0.077$; blood $p = 0.59$). Myocardial T1 did not correlate with heart rate when assessed by either method. After careful exclusion of artifacts, no differences were found between septal and total myocardial T1 values at each slice using either method.

Conclusions: We established pediatric normal values for native T1 mapping using the Smart1Map sequence and compared the results to T1 mapping with MOLLI. Smart1Map showed more robust T1 values among different myocardial slices than MOLLI. Septal values can be used to represent the whole myocardium in cases with suboptimal image quality and diffuse pathology.

Table 1: Myocardial T1 values by Smart1Map versus MOLLI

	T1 Smart1Map [ms]	T1 MOLLI [ms]	
Basal myocardium	1197 +/- 63	996 +/- 35	$p < 0.001$
Mid-ventricular myocardium	1196 +/- 63	1019 +/- 41	$p < 0.001$
Apical myocardium	1223 +/- 60	1053 ± 48	$p < 0.001$