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Timing and variability of late myocardial enhancement imaging in anesthetised pediatric patients

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Introduction

Current protocols for late enhancement imaging using adult techniques do not achieve adequate nulling in children. Young children have faster heart rates, smaller blood volumes and faster circulation. We hypothesize that the timing for late enhancement imaging in adults is not applicable to children.

Purpose

The aim of this study was to determine the best timing for late enhancement imaging in anesthetised children.

Methods

Sedated cardiac MRI was performed on a 1.5 T Siemens Sonata. After IV injection of 0.2 mmol/kg of gadolinium (Magnovist), scout images were obtained at 2, 3, 4 and 10 minutes, and turboFLASH PSIR were obtained using standard views at 5-9 minutes. All images were assessed according to a grading score: 0 = none; 1 = reverse; 2 = poor; 3 = partial; and 4 = good nulling. The inversion time (TI) was determined from the best nulled scout image. Images were analysed by 3 independent observers blinded to the clinical information. The mean and standard deviation of the grading score was analysed using the Kruskal-Wallis analysis and interobserver variability was determined by quadratic weighted kappa statistics.

Results

Twelve children at a median age of 12 months (range: 1-60) were studied. The indication for MRI was to evaluate the anatomy in congenital heart disease (n = 7) or function in cardiomyopathy (n = 5). One patient with a cardiomyopathy had positive enhancement in the RV free wall with the rest being negative. There was good agreement between observers for scout images at 2 (κ = 0.69) & 3 (κ = 0.66) minutes and a moderate agreement at 4 min (κ = 0.57). Agreement of PSIR images was moderate at 7 min (κ = 0.44) and poor-fair at other times. Linear regression analysis showed a significant correlation between TI and scout time ($r = 0.61$, $p < 0.0001$). The mean increase in TI from the 4-10 min scout was 50 ± 15 msec. There was no

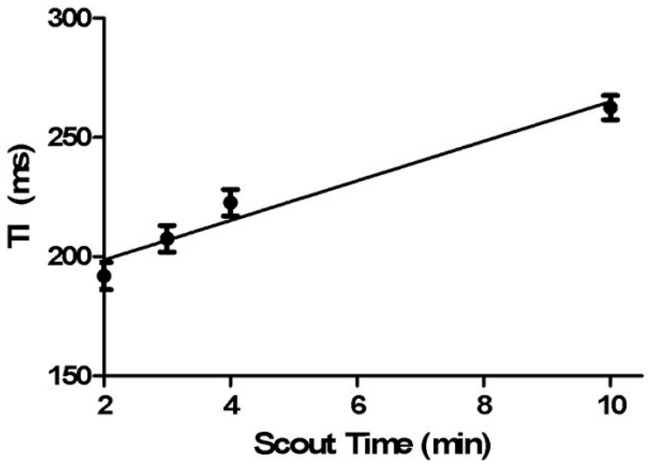

Figure 1
Effect of scout time on inversion time.

Table 1: Grading score

Grade	Degree of nulling	Myocardium appearance	Blood pool appearance
0	none	can't distinguish between myocardium & blood	can't distinguish between myocardium & blood
1	reverse	white	black
2	poor	grainy	white
3	partial	some black areas, some grainy areas	white
4	good	black	white

difference in grading between the scout images from 2-4 min. The highest graded PSIR at 7 min (3.17 ± 0.72) was not significantly higher than at other times Figure 1 and Table 1.

Conclusion

Use of scout images at 2-4 min can be used to determine the TI with little variability. PSIR images, although showing more variability, should be collected immediately thereafter with image quality highest at 7 minutes. The TI increases linearly with time and should be adjusted by approximately 50 msec during late enhancement imaging. Thus adult techniques for late enhancement imaging should not be adopted in children.