

Comparison of Single-Shot TrueFISP and 3D TurboFLASH MR Sequences with 2D Inversion-Recovery TurboFLASH for the Detection of Hyperenhancement in Patients with Myocardial Infarction

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Introduction

The current established standard for viability imaging of the myocardium is post-contrast breath-hold ECG-gated segmented inversion-recovery spoiled gradient echo with inversion time adjusted to ensure nulling of uninfarcted myocardium (IR-TurboFLASH). We investigate two alternative sequences to determine if a combination of whole heart 3D breath-held IR-TurboFLASH and non-breath-held single shot balanced gradient echo, SS-TrueFISP, are as accurate for quantification of infarcted myocardium (Figure 1).

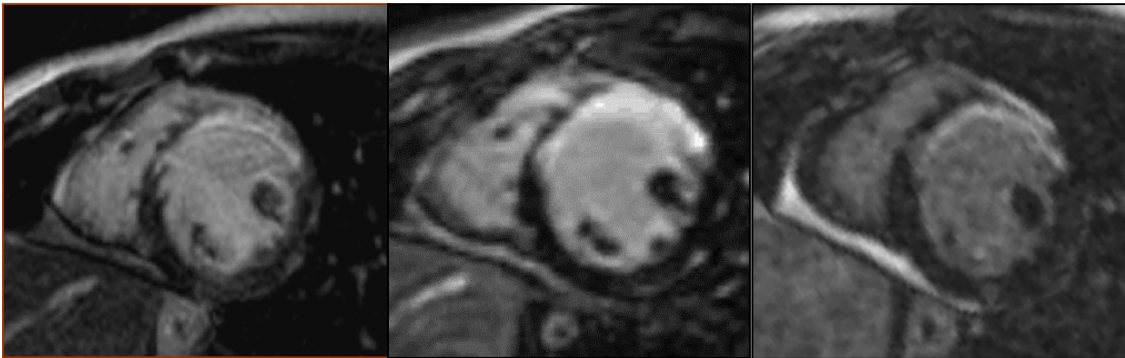


Figure 1, Comparison of short-axis myocardial viability imaging using standard 2D IR-TurboFLASH (left), 3D IR TurboFLASH acquisition (middle) and single shot TrueFISP (right) techniques.

Purpose

To determine whether assessment of myocardial infarction in two alternative MR sequences was as accurate as the current standard.

Methods

40 consecutive patients with clinically proven myocardial infarction underwent MR imaging with all three sequences on a 1.5T scanner (Siemens Magnetom Sonata, Malvern, PA). An experienced physician graded analogous short axis images of the left ventricle at the cardiac base, mid-ventricle and apex for the presence and extent of transmural hyperenhancement using 25% increments. Analysis was performed on a PACS workstations (GE Centricity, Milwaukee, WI) using a 14 segment model (Figure 2) with the physicians given images in a randomly selected order while blinded to type of sequence or any clinical information. A five point subjective assessment of image quality was also performed. A second blinded reader independently graded images from 10 randomly selected patients.

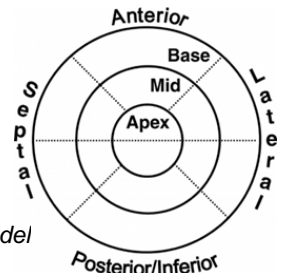


Figure 2, The 14 Segment Model

Results

Using a non-parametric Kruskal-Wallis test, no statistically significant differences in the presence and extent of hyperenhancement were detected in any segments as a function of method (Graph). Statistical Analysis of Variance indicated a significant difference in image quality, with 3D TurboFLASH being rated inferior to the other two sequences ($p < 0.001$ & $p = 0.002$). The second reader's data showed no significant differences for any individual segments ($H = 8.185$, $p = 0.4156$) and no significant variation with the first reader for any particular segment.

Conclusion

SS- TrueFISP and 3D TurboFLASH are diagnostically comparable to IR TurboFLASH in the determination of the presence and transmural extent of myocardial hyperenhancement in patients with myocardial infarction. These sequences gave the same result when using a dichotomous scale of viable (0-49% transmural enhancement) versus non-viable tissue ($\geq 50\%$) and would therefore be essentially identical for clinical decision making purposes.

Graph, Mean extent of transmural enhancement compared for the three sequences at different slice positions. Differences are not significant.

