

Meeting abstract

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1117 Novel high resolution method for visualization of regional ventricular wall motion by 3 T MRI

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Introduction

Assessing the wall motion is important for detecting regional left ventricular dysfunction which may be related to e.g. coronary artery disease (CAD). This study has utilized 3D MRI velocity mapping to quantify the regional motion of the left ventricular wall.

Purpose

The aim of this study was to develop an improved visualization and quantification tool for analyzing regional left ventricular wall motion.

Methods

The velocity measurements obtained from the left ventricular wall were acquired using a 3.0 T GE Signa Excite scanner. Phase shift velocity mapping were utilized to achieve short axis views of the left ventricle throughout the cardiac cycle.

Sequence parameters were TR = 11 mm, TE = 4 ms, Flip Angle = 20°, Slice Thickness = 8 mm, Matrix = 128 × 256.

This velocity mapping was performed on successive slices covering the entire left ventricle. For each slice position, three separate velocity-encoded measurements, comprising all three orthogonal directions, were achieved. Then, by combining velocity information in all three directions, both the direction and absolute velocity of the wall motion, was calculated in every pixel.

Velocity information in a specific direction may be of interest when analyzing contractility of the left ventricular

wall regions. Thus, with velocity acquired in all three directions, we were able to quantify and visualize contractility in any direction throughout the cardiac cycle. For this purpose we developed a Java based workstation.

Segmentation of the ventricular wall was performed by implementing a discrete contour model prepared for interactive use. First initialization of the discrete contour model was performed both manually and by region growing in the first slice. The resulting region of interest (ROI) in the first image was used as initialization for finding shapes in adjacent slices throughout the cardiac cycle across the entire volume.

The velocity patterns were visualized both with colored 3D vectors and by coloring the ventricular wall motion according to absolute velocity or velocity in a specific direction with RGB mapping. In order to view anatomical information and motion at the same time, the velocity patterns were superimposed on images made transparent in the model. The patterns describing the ventricular wall motion were animated in order to generate the movement throughout the cardiac cycle.

Results

Using data from controls and patients with myocardial infarction the workstation was able to present time-dependent ventricular wall motion by combining all three orthogonal velocity components. The presentation of the velocity patterns throughout the cardiac cycle clearly shows the regional left ventricular motion [see figure 1; Left image shows an extensive infarction of the septum

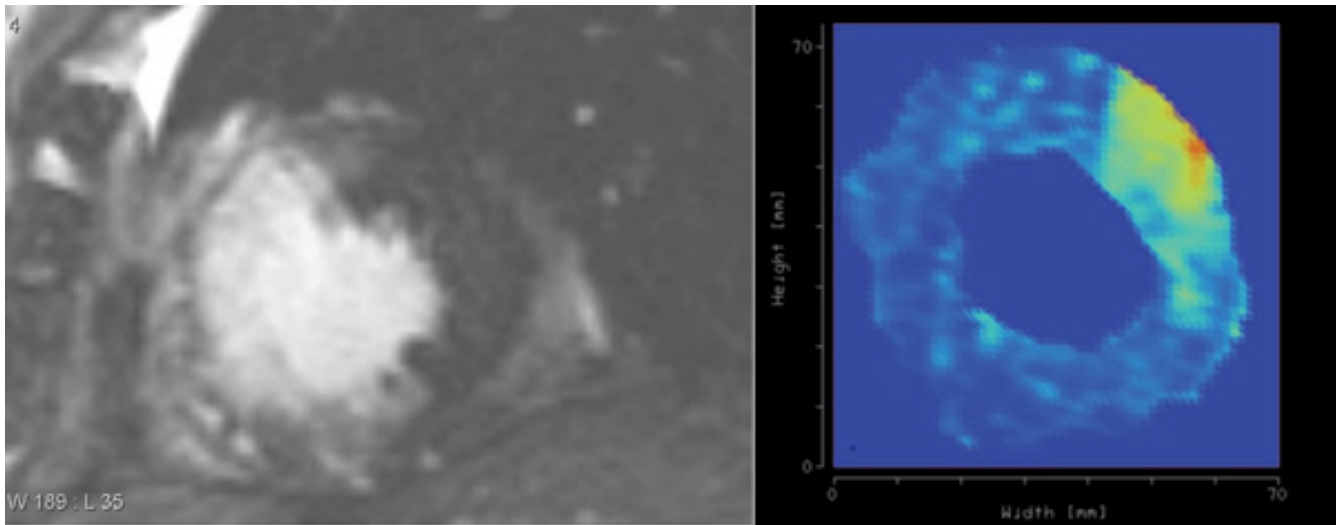


Figure 1

Assessing the wall motion is important for detecting regional left ventricular dysfunction which may be related to e.g. coronary artery disease (CAD). This study has utilized 3D MRI velocity mapping to quantify the regional motion of the left ventricular wall.

and inferior wall by delayed contrast enhancement acquisition; Right image displays high velocities in the viable anterolateral wall during end-systole whereas there is decreased wall motion in the remaining regions of the circumference].

Conclusion

This 3D MRI velocity mapping method improves the accuracy of the regional velocity patterns of the left ventricle and may reveal hypokinetic and akinetic contractions, as well as asynchronous and dyskinetic wall movements. Moreover, applying this technique, a better spatial resolution is obtained in significantly shorter acquisition time compared to the conventional tagging techniques. In addition, the color mapping reflects absolute wall motion velocities which may be of importance in complex CAD where there are regional differences in tissue blood reserve and function.

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