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Meeting abstract

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2090 Right ventricular involvement in reperfused myocardial infarction: an experimental DE-MRI study using inversion recovery prepared SSFP

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Introduction

Right ventricular myocardial infarction (RV-MI) and dysfunction have been shown as independent indicators of poor prognosis in patients with acute myocardial infarction (AMI) [1,2]. Diagnosis of RV-MI is usually made by the presence of an ST-segment elevation of 0.1 mV in the V3R or V4R of the ECG and/or abnormal RV free wall motion on echocardiography. DE-MRI using IR-FGRE (inversion recovery fast gradient echo) has been used to detect the RV involvement in AMI, but its sensitivity and specificity is limited by the thinned wall and confounded by the pericardial fat tissue. We hypothesize that an inversion recovery steady state free precession (IR-SSFP) pulse sequence with the multiple-contrast imaging capability is a better method for the identification of RV-MI.

Purpose

To investigate an IR-SSFP based DE-MRI sequence in the detection of RV-MI in a porcine model with reperfused MI.

Methods

In eight Yorkshire pigs (22–30 kg) a reperfused MI was produced through a 90-minute percutaneous balloon occlusion of the left anterior descending coronary artery proximal to the right ventricular branch. After reperfusion and full recovery from anesthesia, animals were allowed to survive for six weeks (n = 7) and one week (n = 1).

The MR study, which included an SSFP functional study, conventional IR-FGRE based, and IR-SSFP based DE-MRI, was conducted on a GE 1.5 T Signa Excite system. Both IR-FGRE and IR-SSFP were performed 15–20 minutes after double-dose bolus injection of Gd-DTPA. For IR-FGRE, TI varied from 150 to 300 ms, depending on the null of normal myocardium. For IR-SSFP, the SSFP is applied during IR, which means that the longitudinal magnetization is sampled during the transition process from T1 recovery to its true steady-state [3]. For both IR-FGRE and IR-SSFP based DE-MR, the in-plane resolution was around 1 mm*1 mm. Short-axis oblique and/or axial transverse slices were obtained using both pulse sequences. Upon the completion of MRI examinations all animals were sacrificed for macroscopic examination, TTC staining and/or histology for the verification of RV-MI and LV-MI.

Results

The macroscopic examination, TTC staining and/or histology confirmed the presence of LV-MI and RV-MI in all animals (n = 8, Fig. 1A). The gross appearance of chronic MI (n = 7) was gray-white scarring in both LV and RV with increased collagen deposition in histology. In TTC staining, regions of myocardial necrosis were indicated by failure to stain, appearing as a pale-white area in contrast to red-stained viable myocardium. Both IR-FGRE and IR-SSFP based DE-MRI methods identified the presence and extension of LV-MI in all animals. However, the demonstration of RV-MI on short-axis oblique and axial trans-

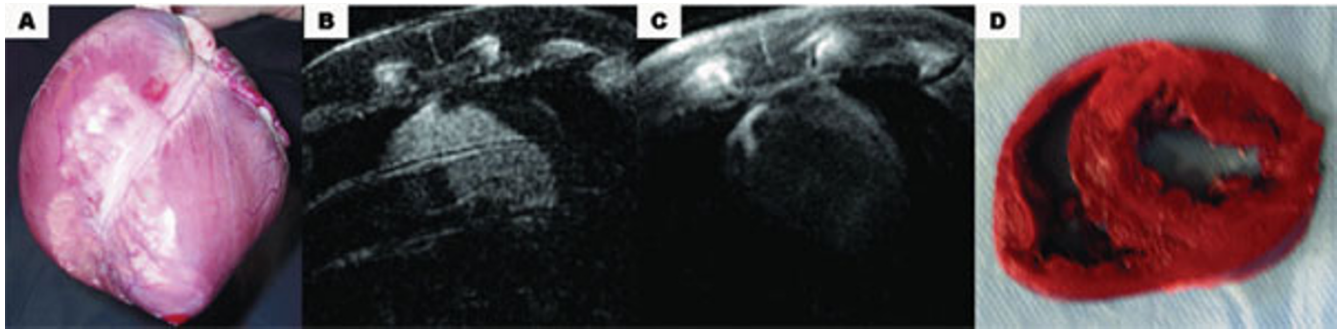

Figure 1
RV Involvment in a porcine model with reperfused MI. A. Gross pale-white appearance of RV-MI and LV-MI. B. Axial IR-FGRE base DE-MRI: RV-MI was barely visualized, LV-MI was seen as delayed hyper-enhancement in the anterior septal region of LV; C. axial IR-SSFP based DE-MRI (same location as B): RV-MI and LV-MI was much better demonstrated; D. TTC staining confirmed the presence of RV involvement.

verse slices was much better using IR-SSFP (87.5%, 7/8) comparing to using IR-FGRE (12.5%, 1/8). The presence of pericardial fat tissue and the thinned wall of the right ventricle were the primary culprits for poor identification of RV-MI using IR-FGRE based DE-MRI (Fig. 1B). The multiple-contrast capability using IR-SSFP enabled better differentiation between the blood pool, pericardial fat and the delayed hyper-enhanced region of RV involvement (Fig. 1C–D), in which the combined RV- and LV-MI appeared as the characteristic MR sign of a transverse or inverted "Y" shape. Moreover, the IR-SSFP provided cine images that also enabled the better appreciation of RV wall motion abnormalities in the region of MI.

Conclusion

Inversion-recovery SSFP based DE-MRI is a better technique for the identification of RV involvement in an experimental model of reperfused myocardial infarction. Further clinical investigation is warranted for the true utility of this technique in the identification of RV myocardial infarction.

References

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