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Poster presentation

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Single breath-hold whole heart coronary MRA with isotropic spatial resolution using highly-accelerated parallel imaging with a 32-element coil array

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Introduction

Whole heart coronary MRA (CMRA) is typically performed with navigator gating because of the extensive data acquisition needed to achieve an isotropic spatial resolution on the order of 1-2 mm^3 with full anatomic coverage (10-16 cm). Previous studies have shown that whole heart CMRA can be performed with either a single [1] or double [2,3] breath-hold (BH) approach using highly-accelerated parallel imaging. The single breath-hold approach [1] acquires the coil sensitivity data immediately before and after the coronary MRA data within the same cardiac cycle, whereas the double BH approach acquires coil sensitivity data in a separate BH. The single BH approach lengthens the time between the T2 and fat suppression pulses to the image acquisition, and the double BH approach may suffer from misregistration. We propose to acquire the coil sensitivity and coronary MRA data in two separate cardiac phases (early systole and mid diastole, respectively) both within a single BH, in order to circumvent the aforementioned problems.

Purpose

To develop a robust single BH whole heart CMRA scan with isotropic spatial resolution.

Methods

Experimental studies were performed in 2 healthy volunteers on a 1.5 T scanner (Siemens;Avanto). The relevant steady state free precession (TrueFisp) pulse sequence parameters are: FOV 360 × 360 × 102 mm^3, Matrix 224 × 224 × 64, slice thickness 1.6 mm, the voxel size is 1.6 × 1.6 × 1.6 mm^3, interpolated to 0.8 × 0.8 × 0.8 mm^3, acceleration-factor 4 × 2 (4 in PE and 2 in PA direction), segment 42, TR 3 ms, TE 1.4 ms, partial Fourier in both PE and PA directions (6/8), slice oversampling-rate 12.5%, T2 and fat-suppression preparation pulses were used. Image reconstruction was performed using the 2D GRAPPA technique. Using identical parameters, we compared two cases: 1) double BH approach and 2) single BH approach where the coil sensitivity and image data are acquired at early systole and mid diastole, respectively (Figure 1). To investigate the inter-study variability, we repeated the image acquisitions for both subjects.

Results

Figure 2 shows representative images that demonstrate improvement using the single BH approach. The new single BH approach produced less "pseudo-noise" artifacts than the double BH approach, owing to improved registration and consistently improved image quality compared with the double BH approach in both subjects during repeated sessions.

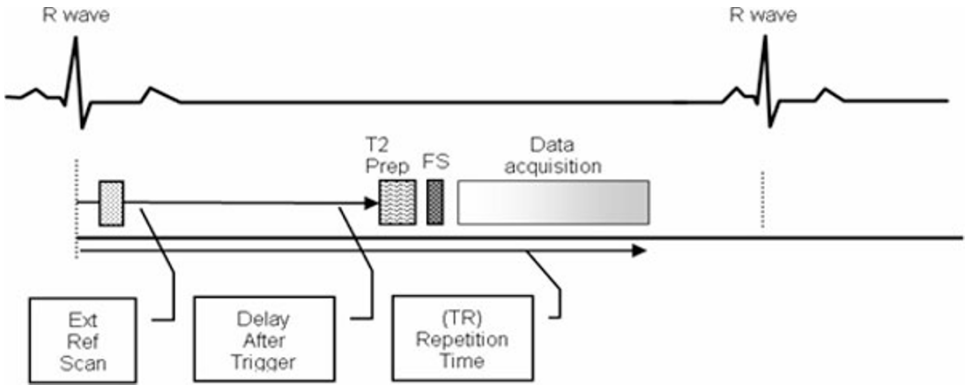

Figure 1
Single BH coronary MRA with the coil sensitivity and image data acquired at two different cardiac phases in the same cardiac cycle.

Conclusion

We demonstrate the feasibility of performing single BH whole heart CMRA with isotropic spatial resolution. Compared with the double BH approach, the new single BH approach yielded less "pseudo-noise" artifacts in the GRAPPA reconstruction. This approach has the potential to improve diagnostic accuracy for rapid volumetric CMRA.

References

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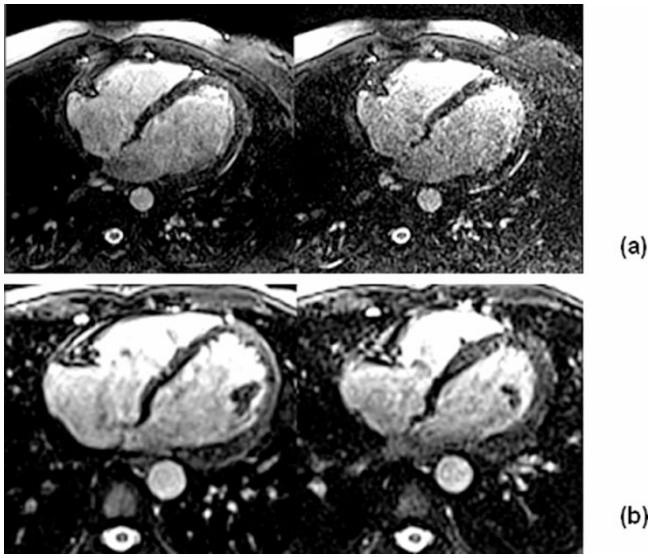

Figure 2
Representative images of subject 1 (top row) and 2 (bottom row): (left) new single BH and (right) double BH.