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Meeting abstract

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2108 Evaluation of whole-heart coronary mra with parallel imaging: comparison of acceleration in one-dimension vs. two-dimensions

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Introduction

Multi-array coils that cover wide area of the body have become widely available. However, attainable advantage of them in the whole-heart coronary imaging has not been much investigated. It has been reported that rapid acquisition using parallel imaging (PI) with high acceleration in one direction largely deteriorates the image quality and acceleration in two direction yields superior image quality.

Purpose

To evaluate degree of scan acceleration and image quality of 2D-PI coronary magnetic resonance angiography (CMRA) in comparison with 1D-PI CMRA using a multi-array coil system.

Methods

We studied 17 healthy subjects (13 males, 23 ± 3 years old) for coronary arteries, after obtaining written informed consent. MR imaging was performed on a 1.5 T scanner equipped with a whole body phased array coil system and 16-channel receivers. The elements were arranged four-by-four at both front and back. Only the two element rows were used to cover the whole heart. The CMRA was acquired in two conditions of 1D-PI and 2D-PI. In both conditions, three-dimensional (3D), centric-ordered, segmented, refocused SSFP sequence (TR 4.3 ms, TE 2.2 ms, flip angle 120°) with respiration gating was used to cover the entire heart in 70 – 80 transverse slices (1.5 mm), and in-plane readout and phase encodings of 256 × 168 resulting in resolution of 1.3 mm and 1.5 – 1.9 mm, respectively dependent on the size of the subjects. The images were reconstructed to the voxel size of 0.6 × 0.6 × 0.75 mm^3. The parallel imaging was applied with in phase direction by factor 2 for 1D-PI and in phase and slice directions by factor 2.5 and 2, respectively for 2D-PI. The acquisition window was segmented into 4 and 3 for 1D-PI and 2D-PI, respectively. The data of 3D CMRA was transferred to a commercially available workstation with image reconstruction software (AZE VirtualPlace Lexus, AZE Ltd., Tokyo, Japan). The CMRA quality was assessed blind to scan conditions in segment-wise with scores 0 – 4 by two radiologists (4: Excellent, 3: Fair, 2: Good, 1: visualized but inadequate for diagnosis, 0: not visualized).

Results

The average heart rate of the subjects was 56 BPM (beats per minute), ranged form 43 to 70 BPM, and the acquisition was performed at stationary period in diastolic phase. The 1D-PI took 695.7 ± 207.0 seconds and 2D-PI took 315.4 ± 133.1 seconds in average ± S.D., reducing the scan time to 45%.

Coronary artery segments were demonstrated in adequate diagnostic quality (scores > = 3) in average for segments #1, 2, 5, 6, 7, 11 for the 1D-PI and for segments #1, 5, 11 for the 2D-PI. Marginal diagnostic quality (2 = < scores < 3) were observed for segments #3, 8, 9, 13, and #2, 6, 7, 13 for the 1D-PI and 2D-PI, respectively. Two segments (#2, 6) showed statistically significant deterioration for

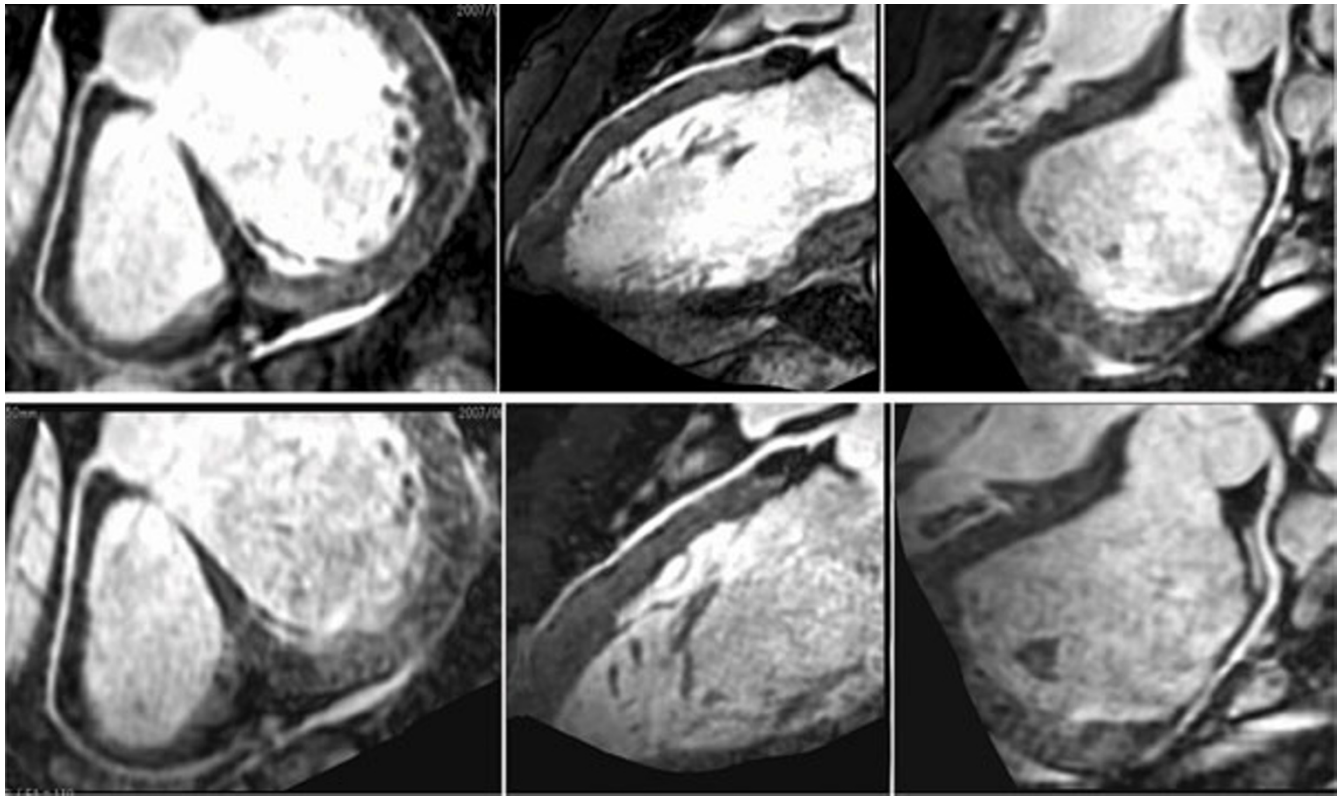

Figure 1
An example of CMRA (Upper: 1D-PI, Lower: 2D-PI). Similar image qualities are obtained in both conditions.

the 2D-parallel scan ($P < 0.05$, after correction of multiple comparisons), however, the average score reduction was 0.34 and only 3 segments (#2, 3, 14) deteriorated by more than 0.5 point (0.53 – 0.65) when compared with the 1D-paralle scan. Differences in scores were relatively small and coronary images were comparable (Figure 1).

Conclusion

The introduction of multi-element phased-array coil systems enable 2D-PI and it has made whole-heart coronary imaging in acquisition time less than half. Although the quality is slightly deteriorated, the amount was relatively small. Such easier implementation will facilitate further use of CMRA in clinical practice.