Non-contrast, free breathing 3D SSFP MR Angiography of Pulmonary Veins: Initial experience

A. Singhal[1], A. Tomasian[1], A. Sassani[2], V. Deshpande[2], G. Laub[2], J. Finn[2], S. Ruehm[2], and M. S. Krishnam[3]

[1]Radiology, UCLA, Los Angeles, California, United States, [2]UCLA, United States, [3]Radiology, UCLA, Los ANgeles, California, United States

Non-contrast, free breathing 3D SSFP MR Angiography of Pulmonary Veins: Initial experience

Contrast enhanced Magnetic Resonance Angiography (CEMRA) has been shown to be an efficient modality for assessment of pulmonary veins with excellent spatial resolution (1). Recently, angiographic and morphologic uses of SSFP have been demonstrated for non-contrast MRA of the arteries and veins (2).

Purpose:
To investigate the feasibility of non-contrast 3D SSFP MR Angiography for evaluation of pulmonary veins and to correlate the results with conventional contrast-enhanced MRA (CE-MRA).

Material and Methods:
Twenty one consecutive patients with known atrial fibrillation underwent free-breathing ECG-gated non-contrast SSFP MRA with non-selective radiofrequency (RF) excitation and conventional high-resolution 3D CEMRA of thorax at 1.5 T prior to RF ablation. Two readers evaluated both datasets for vein definition (from 0, not visualized to 3, excellent definition), artifacts, findings, and intra-vascular signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) in the pulmonary veins. Pulmonary vein ostial measurements were also made in both the datasets. Statistical analysis was performed using Wilcoxon test, t-test, and kappa co-efficient.

Results:
Reader 1 and 2 graded 89 (96.7 %) and 85 (92.4 %) segments on SSFP MRA, and 92 (100 %) and 92 (100%) segments on CE-MRA as having diagnostic or excellent definition (good inter-observer agreement, k=0.68, p< 0.01). Reader 1(2) identified 14(13) and 21 (23) motion artifacts on SSFP and CE-MRA, respectively. Both readers demonstrated an accessory right vein (n=8) on both datasets. No significant difference existed for visibility scores for each reader between the two datasets except for right inferior pulmonary vein which demonstrated lower visibility on SSFP datasets (p<0.05). There was no significant difference in pulmonary vein ostial measurements between CE-MRA (16.3 ± 2.6) and SSFP (15.8 ± 2.7) (P>0.05). Adequate SNR and CNR was achieved in all the veins on SSFP MRA, however, the values were significantly higher on CE-MRA for all segments (P<0.05). Scan time for SSFP MRA ranged from 5 to 10 minutes (mean ± standard deviation, 7 ± 2 minutes).

Conclusion:
Our results demonstrate that non-contrast 3D SSFP MRA provides sufficient vascular definition and SNR and CNR for confident evaluation of pulmonary veins. This technique may be an alternative approach to CE-MRA especially in patients at increased risk for developing contrast-related complications.
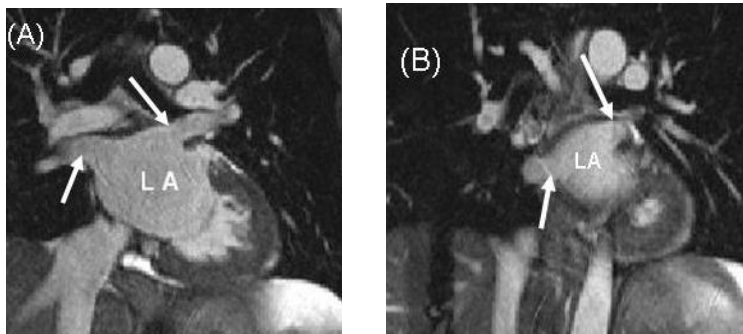

Figure 1 and 2: Non contrast SSFP MRA demonstrating right and left superior pulmonary veins (A) (arrows) and right and left inferior veins (B) (arrows); LA- Left Atrium. Navigator saturation band is seen on the right hemithorax as a well defined vertical bar of low signal intensity.

Reference:
1. Katoh M, et al. Rofo (2006)
2. Hui BK, et al . J Magn Reso Imaging (2005)