Spatially selective excitation applied to aortic vessel wall imaging

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<u>MOTIVATION</u> Aortic vessel wall imaging using MRI is promising for its ability to visualize aortic atherosclerosis [1]. Typically, transverse slices are assessed on which the aorta comprises only a small fraction of the area that is imaged. Spatially selective excitation (SSE) of the aorta could allow a drastic reduction of the area that needs encoding and thus in scan time, by reducing the field of view. We explored the feasibility of using SSE and reduced field of view (rFOV) for imaging the aortic vessel wall.

<u>METHODS</u> All experiments were conducted on a Philips Achieva 3.0T TX system, which features fully flexible amplitude, phase and waveform control over two RF transmit channels. The scans cover the thoracic and abdominal aorta of volunteers, and are made using only one channel to ensure adequate SAR-monitoring. RF waveforms were designed following the method described in [2]. The numerically calculated RF waveform (length=9.6ms) was used in a 3D GRE sequence. Fat suppression (SPIR) and, SENSE reduction factor 1 were applied. To achieve black blood in the aorta in the rFOV acquisition, a saturation band was positioned on the heart in the coronal plane. Isotropic voxel sizes were used to allow for image reconstruction in arbitrary directions.

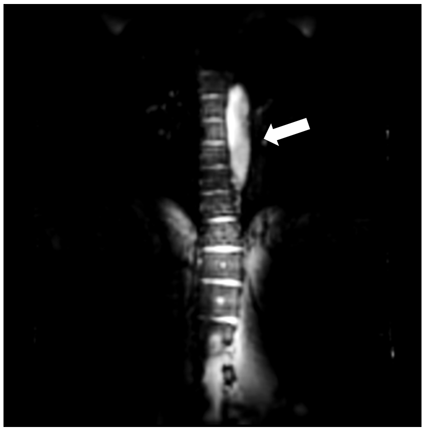
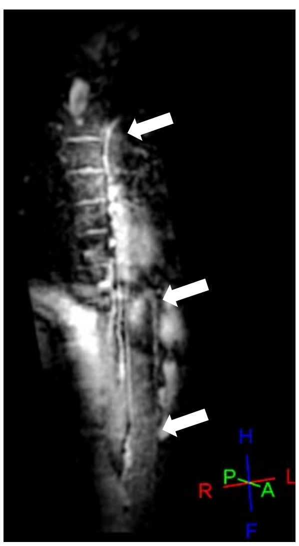
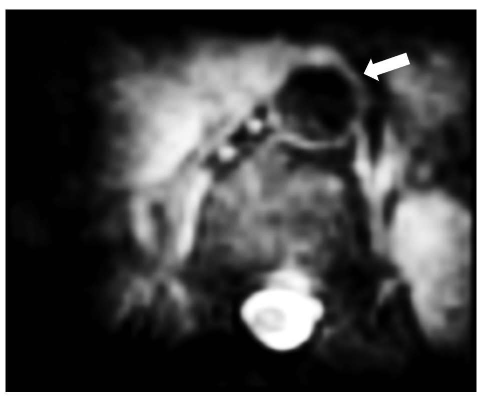


Figure 1. Spatially selective excitation in a full FOV, without saturation band. Parameters: TR/TE: 35/2.3ms, FA~15°, FOV: 400x350x100mm (FHxRLxAP), resolution: 2.5x2.5x2.5mm^3, scantime: 3m11s.

<u>RESULTS</u> A full FOV image is shown Figure 1, demonstrating the spatial selectivity of the excitation which was about 4x8cm (RLxAP). In Figure 2 the results are shown of the acquisition at rFOV with black blood. The aortic vessel wall was visible over a length of 16 cm, which can be seen in the angulated reconstruction of the 3D acquisition. Two reconstructed slices transverse to the aorta are also shown. White arrows mark the aorta in all images.





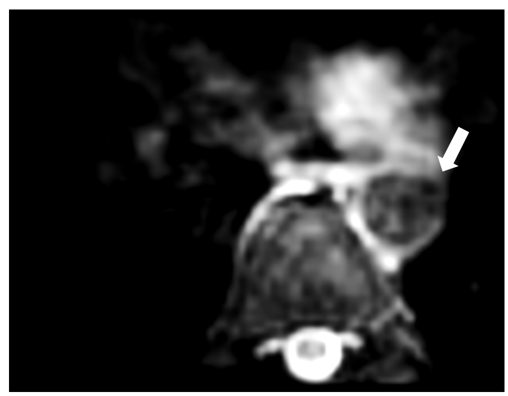


Figure 2. Reconstructions of the rFOV recording. Left**:** angulated reconstruction, Mid: cross section through abdominal aorta, Right: cross section through thoracic aorta. Parameters: TR/TE: 42/2.3ms, FA~15°, FOV: 400x103.2x99.2mm (FHxRLxAP), resolution: 1.6x1.6x1.6mm^3, scantime: 2m43s.

<u>DISCUSSION</u> By limiting the excitation to the aorta and its direct surroundings, we have been able to acquire 100 slices of the aortic vessel wall at 1.6 mm thickness in less than 3 mintues. Additionally, no artifacts due to signal coming from surrounding tissue were observed. Scans that are typically used to assess the aortic vessel wall have an in plane resolution of 1x1mm^2, but use thicker slices: 5mm [3]. Regional saturation was successful in achieving black blood to reveal the vessel wall. Improvement can be made to reduce the signal from blood even further. <u>CONCLUSION</u> This study provides a proof of principle of aortic vessel wall imaging using reduced FOV imaging with spatially selective excitation. <u>REFERENCES</u> [1] Fayad ZA et al. Circulation 2000 pp. 2503–2509 [2] Mooiweer R et al. ESMRMB 2012 pp. 33-34 [3] Hussain T et al. JMRI 2011 pp. 279-285