

**Extended coverage black blood sequences for atherosclerotic plaque imaging: Inflow saturation band and double inversion recovery rapid extended coverage sequences comparison**

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**Introduction:** MRI has been used extensively for atherosclerotic vessel wall imaging. Image quality of two different cardiac-gated multislice black blood techniques (a) fast interleaved double inversion recovery (DIR) rapid extended coverage (REX) [1] and (b) inflow/outflow parallel saturation band (SAT); for vessel wall imaging are assessed in the current study.

**Methods:** Carotid arteries of 4 atherosclerotic patients and 4 healthy volunteers were imaged using the REX and SAT multislice black blood techniques. Twelve slices, 3 mm thick, with a gap of 0.3 mm were acquired with cardiac gating using T2-weighted turbo spin echo black blood sequences on a 1.5T MR system. FOV of 14cm x 14cm, bandwidth of 488 Hz/pixel, matrix size of 256<sup>2</sup> and turbo factor of 15 were used. Quantitative analysis (signal to noise ratio (SNR) and contrast to noise ratio (CNR)) was performed on all slices. All images were also qualitatively analyzed for overall image quality, flow suppression, artifacts (ghosting, motion, etc) and vessel wall delineation by two experienced observers. A 5-point scale with 1 being the poorest and 5 being the best was used. A t-test was used to compare the SNR and CNR values while a Mann-Whitney rank sum test was used to compare the scores obtained using the qualitative analysis.

**Results:** Quantitatively, SNR of inflow/outflow saturation multislice black blood sequences was significantly higher than the corresponding DIR-REX multislice sequences (Mean ± SD = 19.09 ± 6.51 for inflow/outflow saturation vs. 13.3 ± 3.40 for DIR-REX, p<0.05). The CNR (measure of flow suppression) for both multislice sequences were not significantly different (Mean ± SD = 7.89 ± 6.10 for inflow/outflow saturation vs. 7.36 ± 4.19 for DIR-REX sequences, p = NS). Sample images of DIR-REX sequences (a) and SAT multislice sequences (b) are shown in the Figure. Qualitative analysis (Table 1) showed that there was no significant difference between overall image quality, flow suppression and vessel wall delineation comparing SAT multislice sequences with DIR-REX multislice sequences. Artifacts were significantly fewer in DIR-REX sequences as compared to SAT sequences.

**Conclusions:** The DIR-REX sequences had lower SNR but fewer image artifacts as compared to the SAT black blood multislice sequences. Multislice black blood atherosclerotic plaque imaging with DIR-REX may facilitate the study of progression and regression and the integration of these types of studies with routine overall cardiovascular MR evaluation in patients.

Table 1: Qualitative Analysis of inflow/outflow saturation band and DIR-REX multislice black blood sequences

Multislice black blood sequence	Overall Image Quality	Flow Suppression	Artifacts (ghosting, motion)	Vessel Wall Delineation
<b>DIR-REX</b>	3.14 ± 0.83	3.85 ± 0.52	3.31 ± 0.76	3.39 ± 0.85
<b>Inflow/Outflow Saturation</b>	3.30 ± 0.78	3.72 ± 0.51	2.90 ± 0.84	3.56 ± 0.77
<b>p-value</b>	0.212	0.250	<b>0.009</b>	0.247

All values expressed as Mean ± SD, Bold indicates significance (p < 0.05). 5-point scale used, 1-poorest, 5-best

**References:**

1. Mani V et al. . A new interleaved multi-slice black blood double inversion recovery technique for vessel wall imaging. *Proc Intl Soc Mag Reson Med.* 2003; page 163.

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