

# HIGH SPATIAL RESOLUTION 3D CE MRA USING EXTREMELY SMALL-SIZED IRON OXIDE NANOPARTICLES(ESION) AT 3T MRI

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**Purpose:** Extremely small-sized iron oxide nanoparticles (ESION) [1] recently developed an iron oxide based contrast agent was made of 3 nm-sized nanoparticle. Because of small size iron oxide nanoparticles, ESION has low r2/r1 ratio and long blood circulation time, unlike existing superparamagnetic iron oxide nanoparticles (SPIO), and that can be utilized as T1 contrast agent like a gadolinium based one without nephrogenic system fibrosis. This study was carried out to evaluate whether ESION is clinically useful through the animal study that acquired first-pass MR image and high spatial resolution 3D MR angiograph at steady-state to compare with gadolinium based contrast agent (Gd-DOTA).

**Method:** 6 rabbits were examined with ESION and Gd-DOTA on 3.0T MR scanner (Trio Trim, Siemens Healthcare, Erlangen, Germany) using 8-element phase-array coil. Post-contrast imaging with ESION and Gd-DOTA of 3D Flash MRA was started immediately following bolus injection and was repeated at multiple time points for dynamic time-resolved MRA (Coronal, FOV=140x280[mm], TR/TE=2.8/1.0[ms], FA=20[deg], non-interpolated voxel size = 1.1x1.1x1.1[mm<sup>3</sup>] ). It acquired 125um<sup>3</sup> - spatial resolution 3D Flash MRA(Coronal, FOV=140x280[mm], TR/TE=3.82/1.48[ms], FA=20[deg], non-interpolated voxel size = 0.5x0.5x0.5[mm<sup>3</sup>] ) about heart and 27um<sup>3</sup> -spatial resolution 3D Flash VIBE MRA(Coronal, FOV=140x280[mm], TR/TE=3.82/1.48[ms], FA=20[deg], non-interpolated voxel size = 0.3x0.3x0.3[mm<sup>3</sup>] ) about kidney to ESION-enhanced high spatial resolution blood pool MR images.

**Results:** Gd-DOTA-enhanced MR image was seen to rapid excretion through urine within 5 minute of bolus injection. However, ESION-enhanced MR image shown that has long circulating time until after 60minute and run away in the body within a week (Figure 1). We measured signal intensity in each solid tissues and vessels as shown in figure 2 that showed similar results between ESION and Gd-DOTA. Long circulating time of ESION could be made the high spatial resolution MRA that took a long scan time. Figure 3(a) is 125um<sup>3</sup> (0.5x0.5x0.5 [mm<sup>3</sup>]) spatial resolution MR image about heart and (b) is 27um<sup>3</sup> (0.3x0.3x0.3 [mm<sup>3</sup>]) spatial resolution MRA about kidney.

**Conclusion:** This animal study using recently developed ESION has shown possibility as good T1 contrast agent and blood pool contrast agent through comparing between ESION and Gd-DOTA image in first-pass and steady-state 3D MRA.

**References:** B.H. Kim, N. Lee, H. Kim, et al. J. Am. Chem. Soc. 2011, 133, 12624-12631.

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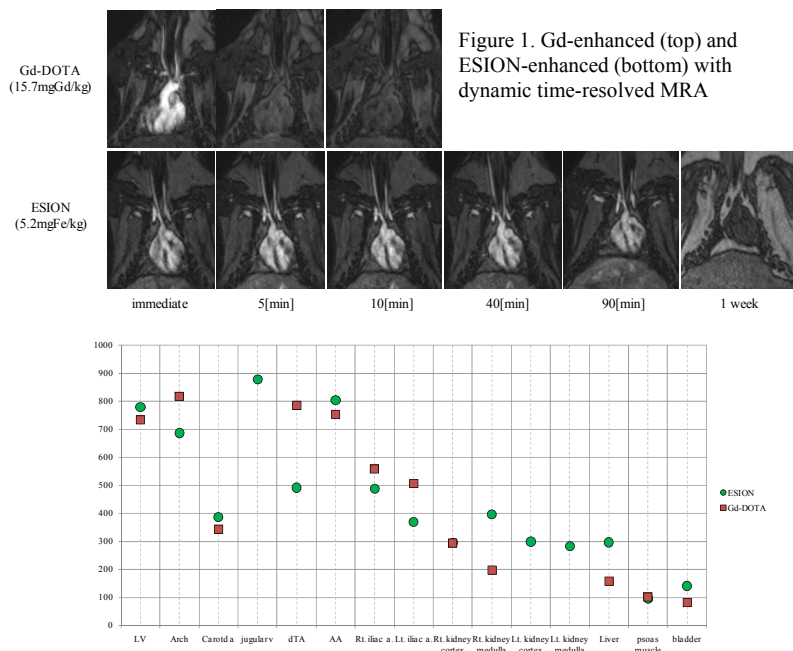


Figure 2. Signal intensity in each tissue between Gd-DOTA and ESION-enhanced MRA

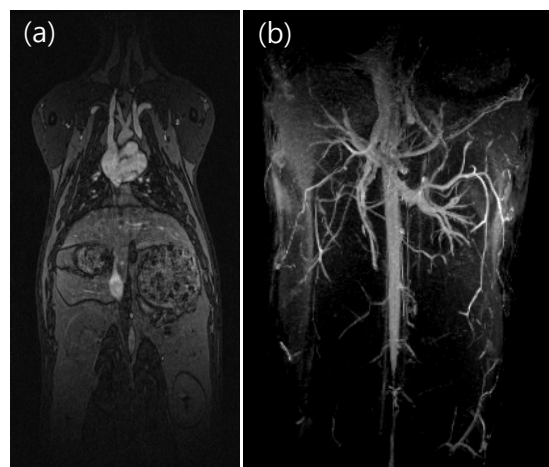


Figure 3. ESION-enhanced high resolution blood pool MRA. (a) 125um<sup>3</sup> 2D-flash image in heart, (b) 27um<sup>3</sup> 3D-vibe MRA in kidney