

Improved Hepatic Arterial Phase MRI with 3 second Temporal Resolution

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Objective: To assess the utility of 3D spiral spoiled gradient echo imaging reconstructed with a 12s sliding window at 3s temporal update rate to differentiate early/middle/late arterial and portal phases.

Methods: One hundred consecutive patients undergoing fluoro-triggered dynamic gadoxetate enhanced liver MRI with standard LAVA (Liver Acquisition with Volume Acceleration) Cartesian k-space acquisition, were compared to sixty one consecutive patients imaged using a spiral k-space trajectory LAVA reconstructed at 3second temporal resolution with sliding window reconstruction. For qualitative analysis bolus timing, hepatic artery branch order visualized, and overall image quality, were graded on a 5-point scale and compared using non-parametric Wilcoxon tests. For quantitative analysis contrast to noise ratio between aorta and liver parenchyma, aorta and portal vein, and signal intensity ratio between aorta and liver parenchyma were calculated and compared using a unpaired student t-test. A p-value of <0.05 was considered statistically significant. This retrospective study was approved by institutional review board.

Results: Spiral LAVA had superior bolus timing scoring 2.0, compared to 1.0 with standard LAVA ($p<0.0001$). Overall image quality and hepatic artery branch order visualization scoring were also superior on spiral LAVA, compared to standard LAVA ($p< 0.001$). MR fluoroscopy triggered single phase standard LAVA produced optimal arterial phase timing in 73% patients, compared to 93% with Spiral LAVA. The aorta to liver parenchyma signal intensity ratio was superior on spiral LAVA 2.8, compared to standard LAVA 2.2 ($p <<0.001$).

Conclusions: Dynamic liver MRI with improved bolus timing is possible using 3s temporal updating while preserving spatial resolution by sharing k-space data with sliding window reconstruction. The overall image quality was superior mainly due to improved bolus timing. The arterial phase was resolved into an average of 5 high spatial resolution sub-arterial phases which may be helpful when the ideal moment in the arterial phase for imaging is unknown or different for different lesions.

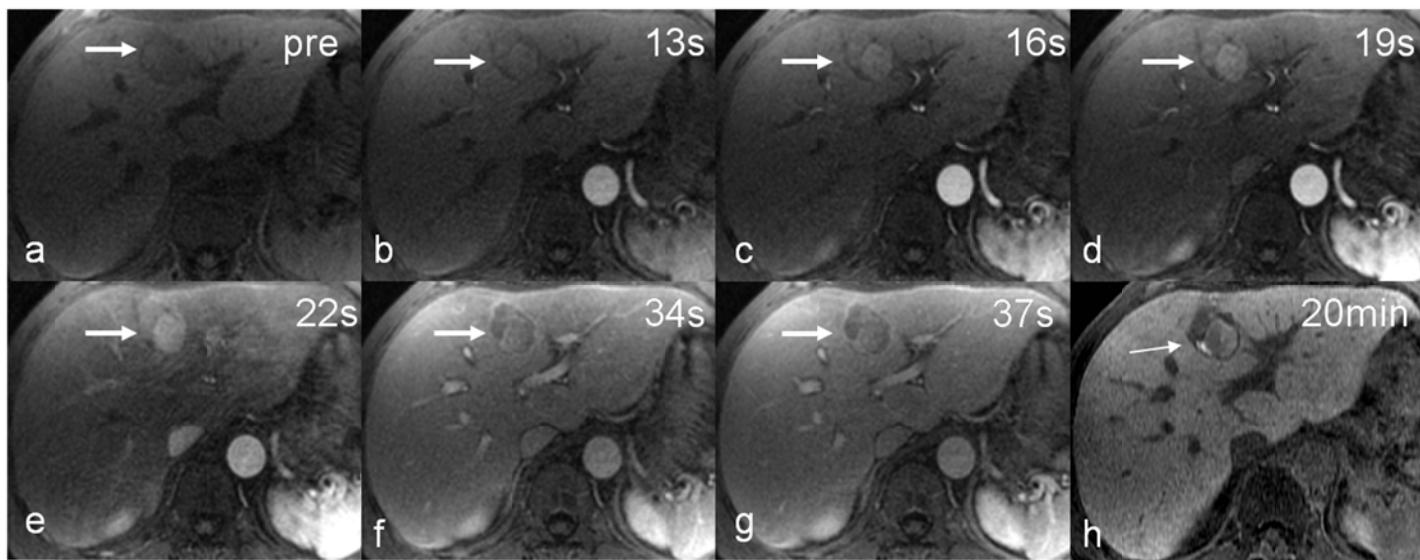


Figure 1: In a 62 year-old-male post gadoxetate axial dynamic spiral LAVA images demonstrates: (a) on pre contrast image, a solitary T1 hypointense (arrow) lesion in segment 4 of the liver, with early to late arterial phase enhancement (b,c,d,e) and early wash out on the portal venous phases (f,g) compared to the rest of the liver parenchyma. A 20 minutes delayed (h) axial standard LAVA image with 30° flip angle, shows gadoxetate retention in the lesion(arrow), consistent with a diagnosis of well differentiated hepatocellular carcinoma (biopsy proven).

References: 1.Mori K et al. AJR 2005;184(1):63-9. 2. Hong HS et al. JMRI 2008;28(2):396-402. 3. Low RN et al. AJR 2010;194(4):947-56. 4. Kanematsu M et al. AJR 2006;187(2):464-72.