Pilot Study of Liver Metastases Imaging with Administration of Ferumoxytol

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Introduction: Recent studies have highlighted the potential of ferumoxytol as an alternative to gadolinium based contrast agents (GBCAs) in adults with chronic kidney disease (CKD) [1] and pelvic vein thrombosis [2]. In this work, we aimed to demonstrate the imaging features of liver imaging after the administration of ferumoxytol with emphasis on potential for liver metastasis workup.

Methods: Ferumoxytol is an ultra-small super-paramagnetic iron oxide (USPIO) particle, marketed in the US as Feraheme and in Europe as Rienso (AMAG Pharmaceuticals, Cambridge, MA) that has been approved in the US and Europe for the parenteral treatment of iron deficiency [1,2]. Aside from its use as an iron supplement, ferumoxytol has excellent potential as a diagnostic imaging agent due to its higher T1 relaxivity (r_1=15.7 $mM^{-1}second^{-1}$ at 1.5 tesla and 9.0 $mM^{-1}second^{-1}$ at 3.0T) compared to conventional extracellular GBCA and long intravascular half-life of 10-14 hours [3]. Importantly, ferumoxytol does not contain gadolinium and is not associated with NSF, making it an excellent alternative to GBCAs for patients with impaired kidney function [4].

We retrospectively analyzed the post-contrast axial or coronal 3D T1-weighted (T1w) image of the liver (15 - 25 min after the administration of ferumoxytol) in 35 patients (age range: 20-93) who underwent MR angiography with/without axial imaging of the liver. Local IRB and informed consent was obtained. Two patients had multiple liver metastases and one had a liver abscess. One patient underwent T2w and 3D T1w imaging 24 hours after the ferumoxytol injection.

Results and Discussion: On post-contrast T1w imaging (15-25 min delay), all patients showed strong enhancement of the hepatic artery comparable to the portal vein and hepatic vein with homogeneous strong enhancement of the liver parenchyma. All liver metastases were seen as homogeneously hypo-intense with no enhancing portion and clear margination.

On 24 hour delayed T2w imaging, liver lesions showed homogeneous hyper-intensity against the dark signal intensity of the liver parenchyma. On 24 hour delayed T1w imaging, the strong enhancement of the hepatic vessels including the hepatic artery was preserved.

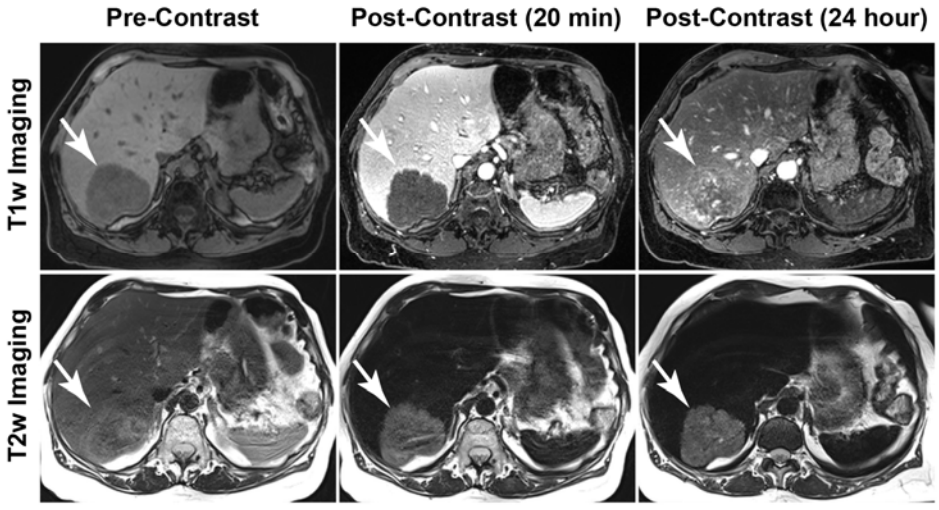

Figure 1: Pre-, 20 min post-, and 24 hour post-ferumoxytol T1-and T2-weighted imaging. The white arrows indicate the liver metastasis.

Conclusion: With regard to the application of Ferumoxytol in the liver imaging, post-contrast delayed T1w and 24 hour delayed T2w imaging have the great potential for improving the detection of metastasis by maximizing contrast between the liver and tumor with no apparent intra-tumoral enhancement. Strongly enhanced hepatic vessels even on 24 hour delayed imaging could be helpful in surgical planning for liver tumor.

References: [1] Lu M, et al., Am J Hematol 2010. [2] Li W, et al., Radiology 2007. [3] McCullough BJ, et al., JMRI 2012. [4] Neuwelt EA, et al., Kidney Int 2009.