

Effect of Dilution of Different Gadolinium Agents on Signal Intensity at 1.5 Tesla: Implications for Direct MR Arthrography

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Target audience: Radiologists who perform interventional procedures.

Purpose: To optimize direct magnetic resonance (MR) arthrography by determining the optimal concentration of gadopentetate dimeglumine (Magnevist), gadobutrol (Gadavist) and gadoversetamide (Optimark) on T1-weighted, T2-weighted, STIR, and gradient-recalled echo (GRE) images at 1.0 T, 1.5 T and 3.0 T.

Materials and Methods: Magnevist, Gadavist and Optimark contrast were diluted into normal saline in multiple concentrations (0.42, 0.54, 0.67, 0.8, 1.0, 1.3, 1.6, 2.0, 2.6, 3.2, 4.0 and 5.0 mmol/L). Eppendorf tubes containing samples were imbedded in clay and scanned at 1.5T using sequences typically acquired for MR arthrography: T1 SE (TR/TE=400/10), PD / T2 FSE (TR/TE=2500/30, 60, and 90), 2D GRE (TR/TE/flip angle=250/10/45) and STIR (TR/TE/TI=3000/30/150). Samples were also scanned at 1.0 T and 3.0 T using equivalent sequences. Signal intensity was measured for each dilution on PACS using a standard ROI; measurements were performed 3 times on each sample and averaged. Graphical analysis of signal intensity vs. gadolinium concentration was performed for each contrast agent.

Results: On T1 SE, all contrast agents tested showed peak signal at a dilution of 2.0-2.6 mmol/L (fig. 1). On FSE PD and T2, signal decreased rapidly and consistently with increasing concentrations, the slope being greater at higher TE (fig. 2). On 2D GRE, there was relatively less variation in signal intensity, with a peak at 2.0 mmol/L for each contrast agent. On STIR imaging two peaks were observed, with high signal at the minimum concentration and an additional peak in signal at 4.0 mmol/L (fig. 2). There was very little difference in peak location and signal intensity between different contrast agents tested.

Conclusion: Findings are in agreement with previous work showing optimal signal at a gadolinium contrast concentration of 2-2.5mmol/L at 1.5T (1-4). There was little difference in signal between different contrast preparations, however two signal peaks were evident.

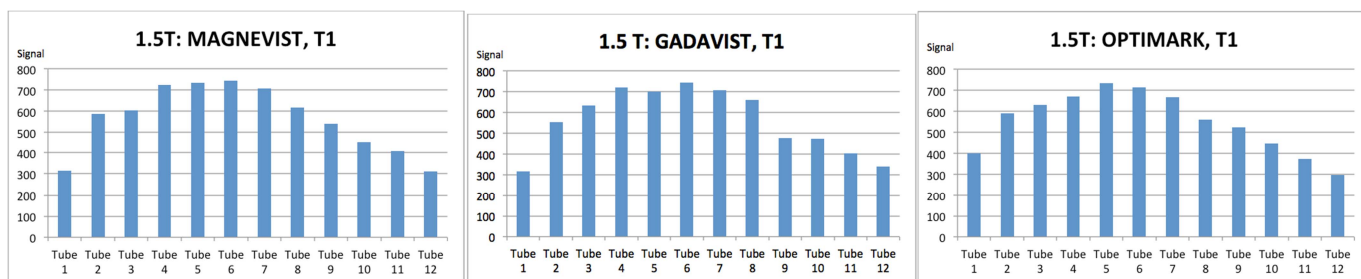


Fig.1. Peak signal at a dilution of 2.0-2.6 mmol/L for different contrast agents on T1 weighted sequence. Left to right = Highest to lowest concentrations

References:

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- 3- Gustav Andreisek, Johannes M. Froehlich, et al. Direct MR Arthrography at 1.5 and 3.0 T: Signal Dependence on Gadolinium and Iodine Concentrations- Phantom Study. Radiology 2008; 247:706-716.
- 4- Ja-Young Choi, Heung Sik Kang et al. Optimization of the Contrast Mixture Ratio for Simultaneous Direct MR and CT Arthrography: an in Vitro Study. Korean J Radiol 2008;9(6):520-525.

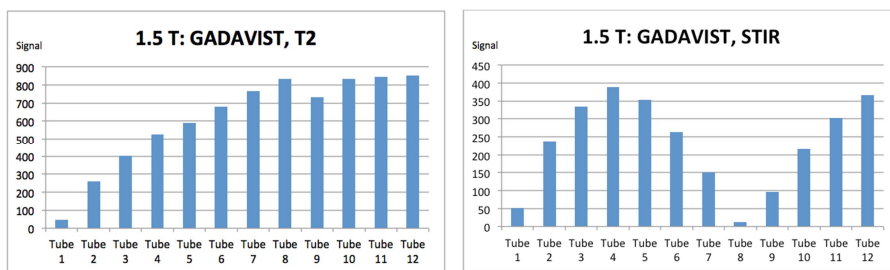


Fig.2. (a) Rapid decrease in signal with higher contrast agent concentration on T2 weighted sequence. (b) Two peaks of high signal observed on STIR sequence. Left to right = Highest to lowest concentrations.