Single Dose (0.1mmol/kg) Brain Magnetic Resonance Imaging with Gadobutrol at 1.5T and 3.0T: Comparison to 0.15mmol/kg Gadoterate Meglumine

H. Kramer[1], V. M. Runge[2], L. G. Naul[2], A. T. Loynachan[3], M. F. Reiser[1], and B. J. Wintersperger[1]
[1]Department of Clinical Radiology, University Hospital Munich, Munich, Germany, [2]Scott and White Memorial Hospital, Texas, United States, [3]University of Kentucky, Kentucky, United States

Purpose: The detection of a possible direct link between the application of Gadolinium based contrast agents (GBCA) highlights the need for dedicated GBCA application protocols [1, 2]. Because of that purpose of the study was to evaluate the efficacy of single dose (0.1mmol/kg bodyweight) gadobutrol compared to a substantially higher dose (0.15mmol/kg bodyweight) gadoterate meglumine in a rat brain tumor model at 1.5T and 3.0T.

Materials and Methods: A cohort of 20 CDF Fisher rats underwent MR exams, either at 1.5T or at 3.0T. All animals were implanted 10µl C6/lac Z Glioma cells using an implanted plastic brain cannula. After 7 days of growth brain MR exams were performed in a randomized order of gadobutrol and gadoterate meglumine with a 24h interval. Both contrast agents are makrocyclic agents but different in concentration. Data acquisition was performed using a T1w TSE technique (TR/TE: 500/16) with a resolution of 0.2x0.2mm^2 and an acquisition time of 1:52min (figure1). All animals were sacrificed after the second MRI and brains harvested for histopathologic assessment (figure 2). Data were evaluated regarding SNR, CNR and lesion enhancement (LE).

Results: Two animals per group died before completing the imaging protocol, thus leaving data of 16 rats for final evaluation. Both, at 1.5T and at 3.0T, no significant differences between the two contrast agents were found in terms of SNR (62.8 vs 62.8, p=0.9 at 1.5T and 100.7 vs104.3, p=0.4 at 3.0T), CNR (25.1 vs 26.4, p=0.9 at 1.5T and 46.7 vs 49.6, p=0.5 at 3.0T) and LE (31.6 vs 31.6, p=0.98 at 1.5T and 56.2 vs 58.6, p=0.6 at 3.0T) (figure 3).

Conclusion: The amount of gadobutrol needed to reach the same efficacy than gadoterate meglumine is substantially lower. This may be beneficial for patients with impaired renal function. Otherwise, also increasing the dose of gadobutrol to 0.15mmol/kg BW can potentially lead to better lesion delineation.

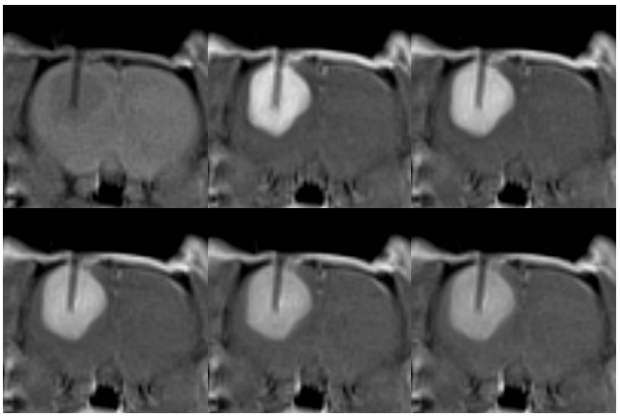

Figure 1: Lesion enhancement over time in an implanted brain tumor. Note the artifact of the surgically implanted cannula.

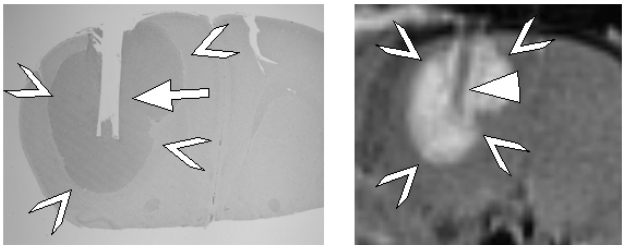

Figure 2: Correlation of a histopathologic slice (A) and a MRI slice (B) of the same tumor. The tumor (open arrowheads), the region of the implanted cannula (arrow) and the cannula itself (arrowhead) can nicely be depicted.

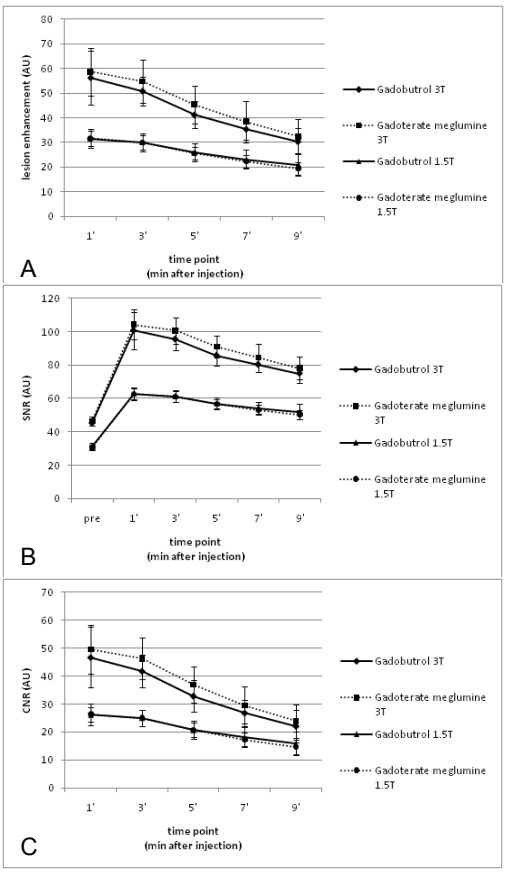

Figure 3: Graphs showing lesion enhancement (A), SNR (B) and CNR (C) curves over time at 1.5T and 3.0T with the two different used contrast agents.

[1] Runge VM. Gadolinium and nephrogenic systemic fibrosis. AJR 2009; 192:W195-196
[2] Sieber MA, Pietsch H, Walter G, et al. Gd-based contrast agents and their potential role in the pathogenesis of nephrogenic systemic fibrosis: the role of excess ligand. JMRI 2008; 27:955-962