CNS Imaging with a High Relaxivity Contrast Agent: What is the Benefit over a Standard Gadolinium Agent?

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Purpose: Several older gadolinium (Gd)-based contrast agents are available for MR imaging of the CNS. These agents have similar T1 relaxivity values ranging between 4.3 and 5.6 $L \bullet mmol^{-1} \bullet s^{-1}$ at 0.47 Tesla. A more recently approved MR contrast agent, gadobenate dimeglumine (GBD), has a two-fold higher intravascular T1 relaxivity (9.7 $L \bullet mmol^{-1} \bullet s^{-1}$) in blood due to weak and transient interactions of the Gd-BOPTA contrast-effective moiety with serum albumin. The purpose of this multicenter study was to evaluate whether this benefit would provide increased diagnostic clinical utility compared with a commonly used older Gd agent.

Methods: A total of 151 patients with a diverse distribution of brain or spine disease were evaluated in a prospective, multicenter, intra-individual, crossover comparative study. Each patient underwent two MRI examinations separated by 2-7 days, one with gadobenate dimeglumine (MultiHance, Bracco Diagnostics Inc.) at 0.1 mmol/kg bodyweight and the other with gadopentetate dimeglumine (GPD, Magnevist, Berlex Laboratories Inc.) at the same dose. Contrast agents were administered in randomized order with investigators blinded to the agent being administered. Images were evaluated qualitatively and quantitatively by three independent blinded neuroradiologists unaffiliated with study centers. Degree and characteristics of contrast enhancement were evaluated, as were differences between the two post-contrast image sets for each patient.

Results: The majority of patients had intracranial tumors, including gliomas (n=47), metastases (n=37), and meningiomas (n=23). For all three blinded readers, the lesion-to-brain contrast-to-noise ratio was significantly greater after GBD than after GPD ($p<0.0001$), with readers 1, 2 and 3 noting relative increases in enhancement over GPD of 22%, 25%, and 26%, respectively. As in earlier studies, highly significant preferences for GBD ($p<0.0001$) were noted by each blinded reader in terms of diagnostic information (lesion border delineation, definition of disease extent, visualization of lesion internal morphology, lesion contrast enhancement, global diagnostic preference). The three readers each demonstrated a global preference for gadobenate dimeglumine in 75, 89 and 103 patients, respectively, compared with just 6, 10 and 3 patients, for gadopentetate dimeglumine. The largest effects of improved enhancement were noted in patients with meningioma (GBD preferred in 52-78% of cases vs 4% with GPD), glioma (GBD preferred in 51-64% of cases vs 2.1 % of cases with GPD), and metastases (GBD preferred in 49-70% of cases vs 5-14% with GPD). Inter-reader (3-reader) agreement was good for all evaluations (kappa values from 0.43 to 0.57).

Conclusions: Results of the largest crossover comparison study to date confirm that gadobenate dimeglumine provides statistically greater contrast enhancement compared with a commonly used gadolinium agent, gadopentetate dimeglumine, for CNS imaging. The relative increase in signal intensity provided by GBD over GPD at the same dose (22-26%) is approximately equal to the increase expected for a double dose of standard Gd agent such as gadopentetate dimeglumine. Gadobenate dimeglumine resulted in marked reader preference and increased diagnostic utility in this controlled study.