Large Scale Comparison of Gadobenate Dimeglumine and Comparator Agents

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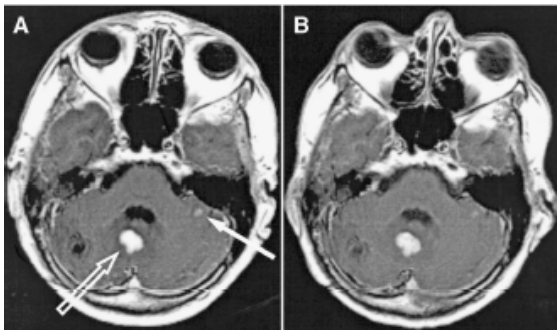
Purpose: To evaluate intraindividual crossover comparisons of gadobenate dimeglumine (Gd-BOPTA) with comparator agents for MRI of CNS lesions.

Methods: 382 patients were randomized to receive 2 MR exams within 2 days to 2 weeks with equal doses (0.1 mmol/kg) of either gadobenate dimeglumine (N=382) or a comparator (gadopentetate dimeglumine [Gd-DTPA, N=237], gadodiamide [Gd-DTPA-BMA N=117], or gadoterate meglumine [Gd-DOTA, N=28]). T1W-SE and T2W-FSE images were obtained before and T1W-SE images after contrast injection. 336 patients were imaged at 1.5T or less while 46 patients underwent higher-field (3T) imaging. Blinded experts assessed post-contrast images for qualitative (eg, global contrast enhancement, lesion-to-brain contrast, lesion delineation, internal lesion morphology and structure, tumor vascularization, and global image preference) and quantitative (eg, contrast-to-noise ratio [CNR]; percent lesion enhancement) efficacy parameters. The Wilcoxon signed rank test was used to evaluate study group differences.

Table 1. Summary of Enrolled Patients and Comparators

Lesion Type	N	Magnet Strength	Comparator(s)
Intracranial metastases (1)	22	0.5, 1, or 1.5 T	Gd-DTPA, Gd-DTPA-BMA, and Gd-DOTA
High-grade glioma or metastases (2)	23	1 or 1.5 T	Gd-DOTA
High-grade glioma or metastases (3)	27	1.5 T	Gd-DTPA
Brain or spine lesions (4)	151	1.5 T	Gd-DTPA
Primary and secondary brain lesions (5)	113	1.5 T	Gd-DTPA-BMA
Primary/secondary brain lesions (6)	46	3.0 T	Gd-DTPA

Results: In the pilot crossover study, sensitivity for lesion detection with gadobenate dimeglumine (93%–100%) was superior to that of comparator-enhanced examinations (65%–73%) (1). The increase in lesion-to-brain contrast of the main lesion was consistently greater with Gd-BOPTA than with the comparators relative to unenhanced contrast (143% vs 127%). A follow on study in 23 patients with high grade glioma or metastases revealed significant ($p \leq 0.005$) overall blinded reader preference for Gd-BOPTA over Gd-DOTA (2). A similar significant preference for Gd-BOPTA was expressed by readers for lesion-to-brain contrast, lesion delineation, internal lesion structure, and overall image preference. Quantitative assessment by off-site readers revealed significantly ($p<0.05$) greater lesion enhancement with Gd-BOPTA than with Gd-DOTA at all times from 2 min after injection. A similar study using Gd-DTPA as the comparator also showed a significant ($p<0.05$) blinded reader preference for Gd-BOPTA for the global assessment of contrast enhancement (3). A preference for Gd-BOPTA was noted for lesion-to-brain contrast and all other qualitative parameters. Quantitative evaluation revealed significantly ($p<0.05$) superior enhancement for Gd-BOPTA compared with that for Gd-DTPA at all time points from 3 minutes after injection. In a large scale study in 151 patients with brain or spine lesions, 3 expert blinded readers noted a significant ($p<0.0001$) overall preference for Gd-BOPTA compared with Gd-DTPA (4). In addition, a significant ($p<0.0001$) preference for Gd-BOPTA was demonstrated for diagnostic information endpoints, percentage of lesion enhancement, and CNR. In another large study using gadodiamide as the comparator, all 3 readers demonstrated a significant ($p<0.0001$) global preference for Gd-BOPTA compared with Gd-DTPA-BMA (5). A highly significant ($p<0.0001$; all readers, all comparisons) preference for Gd-BOPTA was also demonstrated for all individual diagnostic information endpoints and all quantitative evaluations. Finally, at 3T, 3 blinded readers preferred Gd-BOPTA globally in 22 (53.7%), 21 (51.2%), and 27 (65.9%) patients, respectively, compared with 0, 1, and 0 patients for gadopentetate dimeglumine. Similarly, a significant ($p<0.001$) preference was expressed for lesion border delineation and enhancement. Significantly ($p< 0.05$) higher LBR (43.5–61.2%), CNR (51.3–147.6%), and % lesion enhancement (45.9–49.5%) was noted with gadobenate dimeglumine compared to Gd-DTPA at 3.0T.



T1-w SE images obtained with (L) Gd-BOPTA or (R) Gd-DTPA at 3.0T (Rumboldt, et al)

Conclusion: Results from 382 patients enrolled in 6 crossover studies demonstrate that Gd-BOPTA provides better enhancement compared with an equal dose of a comparator contrast agent for the detection and evaluation of intracranial lesions at field strengths ranging from 0.5T to 3.0T. Images produced following administration of Gd-BOPTA demonstrated greater contrast enhancement, provided more diagnostic information including additional lesion detection, and were significantly preferred by experienced, blinded neuroradiologists.

References 1. Colosimo C. *Invest Radiol.* 2001;36:72-81. 2. Colosimo C. *Neuroradiology*. 2004;46:655-665. 3. Knopp MV. *Radiology*. 2004;230:55-64. 4. Maravilla KR. *Radiology*. 2006;240:389-400. 5. Rowley H. *AJNR* 2008; 29:1684-1691. 6. Rumboldt Z. *JMRI*. 2009;29:760-767.