Multicenter Intraindividual Comparison of Gadobenate Dimeglumine and Gadopentetate Dimeglumine in MRI of Brain Tumors at 3 Tesla

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Purpose: To prospectively and intraindividually compare equivalent 0.1 mmol/kg bodyweight doses of the higher-relaxivity contrast agent gadobenate dimeglumine (MultiHance®; Gd-BOPTA) and the standard-relaxivity agent gadopentetate dimeglumine (Magnevist®; Gd-DTPA) for contrast-enhanced MR imaging (CE-MRI) of brain lesions at 3T.

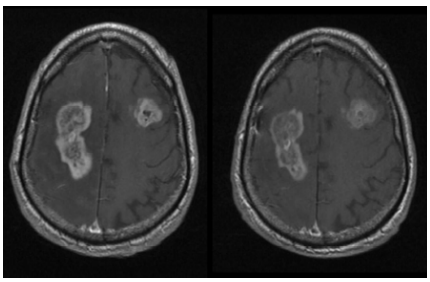
Materials and Methods: Forty-six patients enrolled at 4 centers in the United States were randomized to 2 groups: Group A (n=23; 12 men, 11 women; mean age 50.8±15.5 years) received Gd-BOPTA for the first examination and Gd-DTPA for the second examination. Group B (n=23; 9 men, 14 women; mean age 48.1±16.1 years) received Gd-DTPA first and Gd-BOPTA second. Examinations were performed at 3T (Philips Intera 3T, n=20; GE Signa Excite, n=26) with a standard head coil. All examinations comprised T1wSE, T1wGRE, and T2wFSE sequences acquired before contrast administration followed by T1wSE and T1wGRE sequences acquired after administration of contrast agent at 0.1 mmol/kg bodyweight (0.2 ml/kg injected by power injector at 2 mL/sec). The interval between contrast injection and postcontrast image acquisition as well as the postcontrast sequence order was identical for the two examinations in each patient. Three blinded neuroradiologists evaluated images qualitatively (lesion delineation, lesion enhancement, global preference) and quantitatively (lesion-to-brain ratio [LBR], contrast-to-noise ratio [CNR], % lesion enhancement). Differences were assessed using Wilcoxon's signed-rank test. Reader agreement was determined using kappa (κ) statistics.

Results: A total of 41 patients completed CE-MRI examinations with both Gd-BOPTA and Gd-DTPA. No demographic differences were noted between study groups. Diagnoses were primary glial tumors (23 patients [56.1%]), metastases (4 patients [9.7%]), extraaxial lesions (4 patients [9.7%]), and other (10 patients [24.4%]). Readers 1, 2, and 3 reported global diagnostic preference for Gd-BOPTA in 22/41 (53.7%), 21/41 (51.2%), and 27/41 (65.9%) patients, respectively, compared with 0, 1, and 0, respectively, for Gd-DTPA (Table 1). A similar highly-significant ($p<0.0001$) preference for Gd-BOPTA was expressed for lesion border delineation and contrast enhancement. Reader agreement was consistently good ($\kappa=0.48–0.64$). Significantly ($p<0.05$) higher LBR and CNR were reported with Gd-BOPTA relative to Gd-DTPA: the readers recorded increases of 43.5–52.9% (T1wSE sequences; $p\leq0.0006$, all readers) and 47.3–61.2% (T1wGRE sequences; $p\leq0.0001$, all readers) for LBR, and 63.1–147.6% (T1wSE sequences; $p\leq0.046$, all readers) and 51.3–106.3% (T1wGRE sequences; $p\leq0.02$, all readers) for CNR. Similarly, for percent lesion enhancement, the 3 readers noted increases with Gd-BOPTA of 48.1% ($p<0.0001$), 45.9% ($p=0.0004$), and 46.8% ($p=0.0009$), respectively, on T1wSE images, and 48.6% ($p=0.0019$), 46.2% ($p=0.0008$), and 49.5% ($p=0.0026$), respectively, on T1wGRE images.

Conclusions: Several intraindividual crossover studies performed at 1.5T have demonstrated significantly better contrast enhancement and brain lesion depiction with a 0.1 mmol/kg bodyweight dose of the higher-relaxivity contrast agent Gd-BOPTA relative to an equivalent dose of conventional, standard-relaxivity contrast agent (i.e. Gd-DTPA, Gd-DTPA-BMA) [1-5]. This study confirms that the superiority noted for Gd-BOPTA at 1.5T is maintained at 3T.

Table 1. Qualitative Assessments of 3 Independent Blinded Readers (n=41)

Qualitative Endpoint	Reader	Gd-BOPTA preferred, n (%)	Contrast agents equal, n (%)	Gd-DTPA preferred, n (%)	P Value*
Global Diagnostic Preference	1	22 (53.7)	19 (46.3)	0	<0.0001
	2	21 (51.2)	19 (46.3)	1 (2.4)	<0.0001
	3	27 (65.9)	14 (34.1)	0	<0.0001
Lesion Border Delineation	1	14 (34.1)	27 (65.9)	0	0.0001
	2	11 (26.8)	30 (73.2)	0	0.001
	3	13 (31.7)	28 (68.3)	0	0.0002
Lesion Contrast Enhancement	1	22 (53.7)	19 (46.3)	0	<0.0001
	2	20 (48.8)	20 (48.8)	1 (2.4)	<0.0001
	3	22 (53.7)	18 (43.9)	1 (2.4)	<0.0001



Greater contrast enhancement and better lesion delineation with Gd-BOPTA (left) vs equal dose of Gd-DTPA (right) in a 77-year-old man with glioblastoma. T1wGRE image acquired 6 min after contrast injection.

References

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