Comparison between 0.1 mmol/kg of gadoterate meglumine and 0.075 of gadobenate dimeglumine in brain MRI

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Aims and objectives

To compare a reduced dose (RD) of a high-relaxivity contrast-material (CM) 0.075 mmol/kg of gadobenate dimeglumine (RD-Gd-BOPTA) with a single dose (SD) of 0.1 mmol/kg of gadoterate meglumine (SD-Gd-DOTA), for 1.5 T brain MRI.

Methods and materials

CM changed from SD-Gd-DOTA to RD-Gd-BOPTA since March 2011. Quantitative analysis was performed on 32 patients (54±16 years, mean ± standard deviation) in two subsequent occasions (median interval: 10 months): first using SD-Gd-DOTA, second using RD-Gd-BOPTA. Signal-to-noise ratio (SNR) was obtained for the same anatomic structures on contrast-enhanced T1-weighted images: right and left transverse sinuses; right and left internal carotid arteries at the infra-petrosal level; right and left parotid glands; stable enhancing intracranial lesions (whenever present). Moreover, 102 patients (age 51±19 years) studied with SD-Gd-DOTA were compared with 99 patients (age 54±19) studied with RD-Gd-BOPTA: two radiologists (R1, R2) blinded to contrast regimen, assigned a 0-to-3 point score based on the contrast enhancement (CE). Wilcoxon, #2 and # statistics were used.

Results

At quantitative analysis, median SNR resulted at least equal or even superior using RD-Gd-BOPTA (68-94) than using SD-Gd-DOTA (54-89) [Table 1]. At qualitative analysis, RD-Gd-BOPTA resulted with higher CE if compared to SD-Gd-DOTA (p<0.001), score 3 (optimal CE) being obtained in 50% of SD-Gd-DOTA series and in 80% of RD-Gd-BOPTA series according to R1, and in 38% and 64% according to R2, respectively (the inter-reader reproducibility was substantial: Cohen k=0.717) [Table 2]. [Fig 1 and 2].

Images for this section:
Table 1: Paired comparison between the signal-to-noise ratio obtained using 0.075 mmol/kg of gadobenate dimeglumine (Gd-BOPTA) and 0.1 mmol/kg of gadoterate meglumine (Gd-DOTA)

<table>
<thead>
<tr>
<th></th>
<th>Venous Sinuses</th>
<th>ICA</th>
<th>Parotid Gland</th>
<th>Lesion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Left</td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>Gd-DOTA</td>
<td>83</td>
<td>83</td>
<td>87</td>
<td>89</td>
</tr>
<tr>
<td>Gd-BOPTA</td>
<td>93</td>
<td>92</td>
<td>92</td>
<td>94</td>
</tr>
<tr>
<td>p</td>
<td>0.009</td>
<td>0.037</td>
<td>0.355</td>
<td>0.556</td>
</tr>
</tbody>
</table>

Table 2: Comparison of the qualitative score obtained using the two contrast regimens in two independent patient groups

<table>
<thead>
<tr>
<th></th>
<th>R1</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gd-DOTA</td>
<td>Gd-BOPTA</td>
</tr>
<tr>
<td>Sufficient</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Good</td>
<td>40</td>
<td>16</td>
</tr>
<tr>
<td>Optimal</td>
<td>51</td>
<td>79</td>
</tr>
<tr>
<td>p</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 1: Axial cerebral MRI images T1 weighted after administration of Gd-DOTA (left) and Gd-BOPTA (right). It is remarkable the difference between the contrast enhancement of the meningioma with the two different contrast media.

Fig. 2: Axial cerebral MRI images T1 weighted after administration of Gd-DOTA (left) and Gd-BOPTA (right). Area of altered signal intensity, probably demielinyzing, located on the roof of pons with extention to the base of the 4th ventricle.
Conclusion

In consideration of its two-fold higher T1 relaxivity compared with the standard contrast agents, Gd-BOPTA has been first introduced in radiological practice as a contrast medium for the study of the liver. G. Schneider et al. in their study *Low dose gadobenate dimeglumine versus standard dose gadopentetate dimeglumine for contrast enhanced magnetic resonance of the liver*, demonstrated that Gd-BOPTA administered at the dose of 0.05 mmol/kg gave a diagnostic information at least equal to the one given by a standard contrast agent as Gadopentetate dimeglumine administered at 0.1 mmol/kg [1]. Thanks to its characteristics Gd-BOPTA entered in the neuroradiologic practice, and also in this scientific field many reports in literature have been published [2, 3, 4, 5, 6]. According to Colosimo et al. from the comparison between Gd-DOTA and Gd-BOPTA both administered at the dose of 0.1 mmol/kg in 23 patients with intra-axial tumours, resulted for Gd-BOPTA a significant preference expressed by the readers for the lesion-to-brain contrast, lesion delineation, internal lesion structure, and the overall image [6].

In our study we compared the contrast enhancement in brain MRI obtained using 0.075 mmol/kg of Gd-BOPTA with that obtained using 0.1 mmol/kg of Gd-DOTA.

Regarding the *quantitative analysis*, resulted a contrast enhancement at least equal between the two contrast administration regimens. Nay, even if not statistically significative, the difference was in favour of Gd-BOPTA.

Concerning the *qualitative analysis*, Gd-BOPTA resulted to have a superior contrast enhancement if compared to Gd-DOTA. As a matter of fact, the percentage of examinations evaluated as "with optimal contrast enhancement" moved from 50% for Gd-DOTA to 80% for Gd-BOPTA according to the R1, and from 38% to 64% respectively according to R2.

In conclusion, this study shows that for the routinary neuroradiologic applications, the administration of 0.075 mmol/kg of Gd-BOPTA is at least equal to the administration of 0.1 mmol/kg of Gd-DOTA.

**Personal information**

**References**

1. Schneider G, Maas R, Schultze Kool L, Rummeny E. Low dose gadobenate dimeglumine versus standard dose gadopentetate dimeglumine for contrast-
enhanced magnetic resonance imaging of the liver. Investigative Radiology 2003 Nov; 85-94.


