Contrast Resolution between Myocardial Delayed Enhancement and Intraventricular Blood Using a Single (0.1 mmol/kg) Dose of a High-relaxivity Contrast Agent (Gd-BOPTA)

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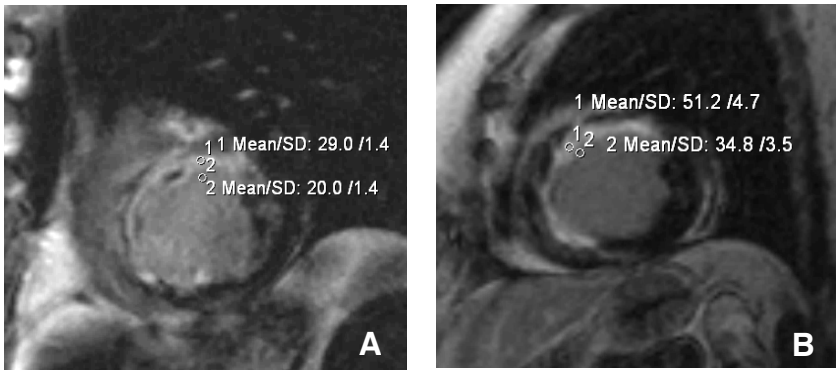
PURPOSE: The detectability of subendocardial infarcts as delayed enhancement (DE) depends on the contrast between infarcted myocardium and intraventricular blood. Since contrast is present in the blood when images for DE are acquired, too high a signal intensity (SI) enhancement may paradoxically lead to a reduced contrast-to-noise ratio (CNR). The high relaxivity contrast agent gadobenate dimeglumine (Gd-BOPTA) produces greater enhancement of SI compared to a standard relaxivity agent at equal dose due to transient weak interaction of the Gd-BOPTA chelate with serum proteins (1, 2). Thus, if Gd-BOPTA is administered at the same dose as a conventional gadolinium agent the greater SI enhancement of the intraventricular blood may result in reduced overall infarct-blood CNR. This was demonstrated recently in a direct comparison of Gd-BOPTA with gadopentetate dimeglumine (Gd-DTPA) at an identical double dose of 0.2 mmol/kg bodyweight (3, 4). Our aim was to evaluate the CNR between myocardial DE and intraventricular blood after injection of a single 0.1 mmol/kg dose of Gd-BOPTA.

METHODS AND MATERIALS: We retrospectively evaluated 21 consecutive patients with ischemic cardiomyopathy (18 males; 3 females; age: 60.5±10.3 years, range: 37-77 years). Each patient underwent cardiac MR at 1.5-T (short-axis IR-prepared FLASH sequence with TE=1.37 ms, FA=10°, thickness=5 mm; optimized TI=190-310 ms). Images were acquired 10 minutes after i.v. injection of 0.1 mmol/kg of Gd-BOPTA. SI was measured at small regions-of-interest (ROI) within myocardial DE, inside the intraventricular cavity near the endocardial surface, and outside the patient. The SI measurements were then used to calculate CNR. Comparison of CNR values was made against a control group comprising seven further consecutive patients (5 males, 2 females; age: 58.6±5.9 years, range: 51-67 years) with ischemic cardiomyopathy who received 0.1 mmol/kg of the standard relaxivity agent (Gadoterate meglumine (Gd-DOTA, Guerbet). Statistical comparison was made using the Mann-Whitney U test.

RESULTS: The SI of infarcted myocardium was significantly (p=.0004) higher in the Gd-BOPTA group (43.7±16.1; range: 18.2-72.2) than in the Gd-DOTA group (20.4±5.7; range: 13.0-29.0). Likewise, the SI of intraventricular blood was significantly (p=.016) higher in the Gd-BOPTA group (34.8±14.8; range: 9.0-67.4) than in the Gd-DOTA group (14.1±5.1; range: 9.4-20.8). No significant difference between groups was noted for the infarct-blood CNR (9.6±6.5, range: 1.0-23.4 in the Gd-BOPTA group; 8.4±4.9, range: 3.6-17.2 in the Gd-DOTA group).



Myocardial post-infarction delayed ehancement in two different patients, obtained using 0.1 mmol/kg of Gd-DOTA (A) and 0.1 mmol/kg of Gd-BOPTA (B) ten minutes after intravenous administration.

CONCLUSION: Taking into account the study limitations (retrospective and non-intraindividual comparison), these data support the hypothesis that a single (0.1 mmol/kg) dose of Gd-BOPTA permits significantly greater delayed enhancement of both infarcted myocardium and intraventricular blood without reduction of CNR. The need for only a single dose of Gd-BOPTA compared to a frequently higher dose of conventional agent (3) permits savings of both contrast agent and associated costs. The use of a single dose of Gd-BOPTA has previously been evaluated in both research trials (5) and daily clinical practice (6). From a clinical perspective, it should also be pointed out that perfusion imaging is typically performed before any evaluation of delayed enhancement. In most cases perfusion imaging (at rest or under pharmacological stress) is performed with 0.05 mmol/kg of contrast agent, prior to the injection of a second 0.05 mmol/kg dose to complete the perfusion study or to obtain the final 0.1 mmol/kg dose required for delayed enhancement. Specifically designed intra-individual dose-finding studies are needed for Gd-BOPTA-enhanced delayed enhancement of acute, subacute, and chronic myocardial infarct, to compare doses from 0.05 to 0.2 mmol/kg bodyweight using both single bolus or fractionated administration regimens.

References

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