3D MR Colonography after exclusive intravenous administration of a hepatobiliary contrast agent

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Introduction
Cross-sectional imaging of the colon has been recently introduced as MR or CT colonography. All methods rely on the aboral or oral administration of a contrast agent, which does change the physiological function of the colon. While performing several clinical studies using a partially hepatobiliary excreted contrast agent, we noted substantial intraluminal colonic contrast 24 hrs post injection. Subsequently, we investigated the potential of exclusive contrasting the colon via a hepatobiliary excreted MR contrast agent for 3D MR colonography.

Methods
Six volunteers were enrolled in a MR angiographic study of the abdominal vasculature with gadobenate dimeglumine at 0.1 mmol/kg body weight. The volunteers were studied according to an angiographic protocol approved by the IRB and performed according to GCP. Prior written informed consent was obtained from each volunteer. Gadobenate Dimeglumine (Gd-BOPTA, Multihance, Bracco Diagnostics, Princeton, NJ) exhibits a partial hepatobiliary excretion (reported 2 - 4 %). Follow-up imaging using a 3D MR angiographic-(MRA) sequence (3D FLASH; TR 4.6 ms; TE 1.8 ms; a 50°; rect. FOV 390 mm (6/8); Ma: 215x512; acquisition time: 28 s; slab thickness: 120 mm; 42 partitions) was carried out at 1, 12, 24, 36, 48, 70, and 105 h post injection in all subjects. In addition to the 3D MRA-sequence, T1-weighted axial images of the liver and abdomen were obtained. The subjects were instructed to document their dietary patterns. No contrast enema nor any medication was given. All imaging was performed on a 1.5 T MRI scanner equipped with a phased array body coil. Post-processing was performed on the system work station using standard MIP software.

A blinded reader analysis of the MIP as well as of the cross-sectional images was performed by an experienced radiologist. The intensity and extent of intraluminal contrast enhancement as well as of the diagnostic potential was assessed using a continuous scale from +5 (excellent) to −5 (none). Quantitative blinded assessment was performed by placing regions of interest (ROI) within the gall bladder, the contrast-enhanced bowel in the colon and the liver parenchyma.

Results
Intense, homogenous contrast enhancement within the colon was observed within 24 hrs in all subjects. The bowel stools revealed homogenous enhancement within the lumen indicating thorough mixing of content comparable to bile acids. The signal intensity of the liver parenchyma and within the gallbladder decreased after the first hour with an initial halftime of 10 - 15 hrs. The highest signal intensity in the colon was detected at 16 - 50 hrs post injection. The quality of enhancement was sufficient to enable 3D processing for virtual colonoscopy. No relevant enhancement could be detected in the small intestine except in the small intestine in the terminal ileum. Enhancement in the colon was detected up to 100 hrs in all subjects.

Fig.1 demonstrates the extent on colon enhancement 24 hrs post injection without any other intervention. Note the high, homogenous intraluminal contrast as well as the physiologic colonic haustration. The average signal intensity observed over time after injection is shown in Fig. 2 for the liver parenchyma, gallbladder and colon.

Discussion
We established the feasibility of MR colonography after using only an intravenous MR contrast agent with partial hepatobiliary excretion. This new diagnostic procedure will enable not only morphologic assessment of the colon, but also functional and pathophysiological studies on the transport kinetics of bile and stool without any preparation of the patient and without any necessary muscle relaxing medication such as Glucagon (or Buscopan). While the utility for functional studies of the unaltered colon is obvious, its efficacy for luminal diagnostics such as polyp's and small cancers remains to be determined.

References


