Comparison of different techniques for MR colonography

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ABSTRACT:

The study was performed to compare contrast–enhanced dark lumen MR colonography (MRC) with bright lumen MR colonography (not requiring i.v. contrast administration) based on 2D TrueFISP images for the detection of colorectal masses. 31 patients underwent both bright-and dark lumen MRC. MR findings were compared to conventional endoscopy. While dark-lumen MRC was able to visualize all colorectal masses larger than 5mm, bright lumen MRC was less sensitive. With the bright-lumen approach false-positive results were present in 5 patients, whereas dark-lumen MRC did not provide any false-positive findings.

INTRODUCTION:

MR colonography (MRC) is an appropriate diagnostic tool for detecting colorectal polyps exceeding 8mm in size [1]. Different techniques of MRC have been described. "Dark lumen" MRC is based on the administration of a rectal water-enema combined with the intravenous injection of paramagnetic contrast [2]. On 3D GRE data sets the colonic wall as well as masses arising from it show bright enhancement. Thus, bowel wall and colorectal masses can easily be delineated against the background of the dark colonic lumen. With "bright lumen" MRC colorectal lesions are visualized as dark filling defects within the bright colonic lumen. This can be achieved by administering a rectal enema containing paramagnetic contrast [1]. On 3D gradient echo data sets only the contrast-containing colonic lumen is bright whereas the surrounding tissues including colonic wall and polyps remain low in signal intensity. A new approach for "bright lumen" MRC is based on the acquisition of TrueFISP sequences. Using a rectal water-enema, the contrast mechanism is comparable to that of the approach in conjunction with a paramagnetic contrast enema and the acquisition of T1w GRE sequences. Since the TrueFISP technique neither requires the administration of intravenous nor rectal paramagnetic contrast medium, it appears economically attractive. The purpose of this study was to compare dark lumen MRC with the described TrueFISP based bright lumen technique for the detection of colorectal masses..

METHODS:

31 patients with suspected colorectal lesions were included in this study. MR examinations were performed on a 1.5 T MR system (Magnetom Sonata, Siemens Medical Systems, Erlangen, Germany). The colon was filled with 2000ml of tap water. The TrueFISP sequence was acquired both in supine and prone position (TR/TE: 4.45/2.23ms, flip angle 70°, field of view (FOV) 400 x 400mm, slice thickness 3mm, acquisition time 21sec). For the dark lumen technique, data acquisition was performed with the patient in prone position only. For the 3D GRE sequence the following parameters were used: TR/TE: 1.64/0.6 ms, flip angle 15°, field of view (FOV) 400 x 400 mm, effective slice thickness 1.57mm, acquisition time 23 sec. Paramagnetic contrast (Gd-BOPTA, Multihance, Bracco, Italy) was administered i.v. at a dose of 0.2 mmol/kg and a flow rate of 3.0 ml/s. After a delay of 75sec, the 'pre-contrast' 3D acquisition was repeated with identical imaging parameters. In addition to MRC all patients underwent conventional colonoscopy on the same day of the MR examination.

RESULTS:

Conventional colonoscopy detected 20 colorectal polyps in 11 patients and three colorectal cancers in three patients. Based on dark-lumen MRC, all polyps >5mm were correctly diagnosed (fig 1), whereas 4 polyps ≤5mm were missed. Thus, sensitivity of dark-lumen MRC amounted to 83%. There were no false-positive results: residual stool could correctly be differentiated from polyps due to the lack of contrast enhancement. TrueFISP based bright lumen MRC, however, failed to detect seven polyps (all <10mm). In addition, bright lumen MRC showed false positive findings in 5 patients (fig 2). Bright lumen MRC reached a sensitivity of 74% for the detection of polyps/masses.

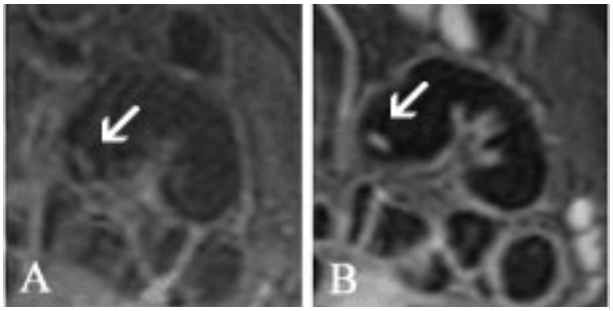

Fig 1: 3D T1w GRE scan shows 8mm polyp in the sigmoid colon. Lesion can be distinguished from residual stool due to contrast enhancement comparing native (A) and post contrast scan (B).

DISCUSSION:

A particular advantage of bright-lumen MRC with TrueFISP is that no paramagnetic contrast neither for intravenous nor rectal administration is needed. In addition, the sequence is rather insensitive to motion artifacts. However, in this study even polyps larger than 5mm were missed, and there was a considerable number of false positive findings due to the problem differentiating between residual stool and colorectal masses. The dark lumen MRC in conjunction with intravenous application of paramagnetic contrast proved to be superior for the detection of even small polyps. Polyps could be clearly identified based on the uptake of contrast agent. Thus false positive findings were not seen. However, further developments such as the use of 3D TrueFISP sequences or the employment of potential sequence strategies for a better differentiation of residual stool vs. polyps might enhance the impact of a bright lumen imaging approach based on TrueFISP.

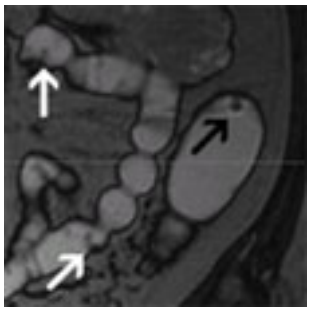

Fig 2: 7mm polyp (black arrow) detected on TrueFISP data set. It is difficult to differentiate between polyps and residual stool (white arrows) due to similar contrast characteristics.

REFERENCES:

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2. Lauenstein TC et al. Dark lumen MR-colonography: initial experience. Rofo 2001 Sep;173(9):785-9