Digital subtraction dark-lumen MR colonography for lesion detection – Initial experience

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INTRODUCTION

Dark-lumen MR colonography combining a water enema with intravenous contrast administration is a rapidly evolving, minimally invasive method of evaluating the entire colon (1-2). Results of several preliminary series indicate that this technique has a high sensitivity for detection of colorectal cancer and significant polyp lesions as well as inflammatory disease of the bowel (3). Since bowel movements are depressed during the examination a digital subtraction technique comparable to vascular studies might be applicable and facilitate detection of regions with increased contrast uptake.

METHODS

After receiving institutional review board approval, we performed dark lumen MR colonography on 13 subjects in whom colonic malignancy was suspected. Patient preparation included abrosia the night before the examination and bowel purgation. For MR colonography the colon was filled with 2000 ml of body-warm tap water while Gadobenate dimeglumine (MultiHance, Bracco Sp.A., Milan, Italy; 0.2 mmol/kg) was injected intravenously. Scopolamine (n=16) or glucagon (n=4) was administered and instillation of the enema was carried out in stages over a 2-minute period to minimize discomfort and bowel cramping. Subjects were instructed to hold their breath during image acquisition. All imaging was performed at 1.5 T (Magnetom Sonata, Siemens, Erlangen, Germany). A three-dimensional T1w GRE sequence (VIBE) was acquired before and 75 sec after the contrast administration in the coronal plane (TR/TE 6/15ms, flip 25°, TA 23sec, FOV 400 x 400 mm). We performed the postprocessing steps of digital subtraction on a standard software platform (Leonardo, Siemens Medical Solutions). All data were assessed on two separate occasions by two radiologists in consensus: Once without the subtracted data set, the second time with the extra images. The read-outs were separated by four weeks and performed in random patient order. Evaluation time and number of lesions detected in the read-outs were compared. The standard of reference was conventional colonoscopy in all cases.

RESULTS

Digital subtraction of dark-lumen MR colonography data sets results in images, in which focal contrast uptake of the wall is easily detectable, such as small polyps (Fig. 1, 2). As currently implemented, no extra imaging time is needed for the post processing. In comparing the assessment of the data without and with the subtracted images, we found a significant reduction of the read-out time when using the subtracted data set (6:41 min vs. 7:39 min). In addition, one polyp (5 mm) was detected on the subtracted data which was initially overseen on the first read-out. Nevertheless conventional endoscopy detected two polyps (3 and 4 mm) that were missed in the MR exam. The overall sensitivity and specificity of 0.8/1.0, respectively.

DISCUSSION

Digital subtraction of dark-lumen MR colonography data sets offers the possibility of reducing read-out time together with an increased sensitivity for detecting areas of increased contrast media uptake, which in turn can lead to an increased specificity for delineation of colonic pathologies. Finally, although the preliminary data we present are encouraging, a study using a larger cohort is needed to provide rigorous validation of dark-lumen MR colonography with digital subtraction.

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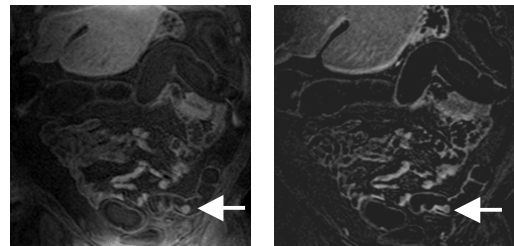
Fig. 1: Contrast-enhanced (left) and subtracted data of a patient with a large polyp (arrow) in the sigmoid which was correctly detected by both techniques.
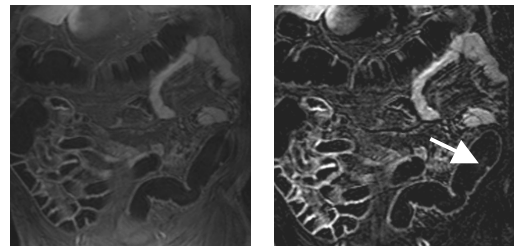

Fig. 2: Contrast-enhanced (left) and subtracted data of a patient with a small polyp in the colon, which was only correctly identidied on the subtracted image.missedlarge polyp (arrow) in the sigmoid which was correctly detected by both techniques.