Abstract

Purpose: To assess a new strategy of MR colonography for the detection of colorectal polyps/cancer. Material and Methods: 21 subjects underwent MR colonography prior to conventional colonoscopy. MRC is based on a rectal enema with water in combination with the intravenous application of a paramagnetic contrast agent. Results: MRC correctly identified five polyps in four patients. One flat adenoma seen at colonoscopy was missed by MRC. Conclusion: The new MRC concept based on a dark colonic lumen and a bright, contrast enhanced colonic wall appears to be a promising alternative to traditional MRC based on a bright colonic lumen.

Introduction

Virtual colonography (VC) has been found to be highly sensitive for detecting colorectal polyps exceeding 8 mm in size [1,2]. Despite high diagnostic accuracy, the considerable exposure to ionising radiation casts a shadow over the future of CT colonography as a screening exam for colorectal cancer [3]. Hence, efforts have been focused on MR colonography (MRC). To date, MRC has been based upon the administration of a rectal enema containing paramagnetic contrast. 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. Hence the technique has been referred to as 'bright lumen' MRC. Polypoid colonic masses appear as dark filling defects within the bright colonic lumen – an appearance which is difficult to differentiate from residual fecal material and/or small pockets of air. To compensate for the presence of residual air, the 3D acquisition is performed in both prone and supine positions. The purpose of this study was to assess a simplified, less costly variation on MR-colonography – MRC of the contrast-enhanced colonic wall. The technique is based on the acquisition of a 3D gradient echo sequence collected after administration of a rectal water-enema and an intravenous injection of paramagnetic contrast. The colonic wall as well as masses arising from it brightly enhance and are thus easily delineated against the background of a dark colonic lumen (‘dark lumen’ MRC).

Methods

21 patients with suspected colorectal lesions were included. Following standard preparation for bowel cleansing MR examinations were performed on a 1.5 T MR system (Magnetom Sonata, Siemens Medical Systems, Erlangen, Germany). The colon was filled with 2500-3000 ml of warm tap water. Data acquisition was performed with the patient in the prone position, only. For the 3D sequence the following parameters were used: TR/TE 1.64/0.6 ms, flip angle 15°, field of view (FOV) 450 x 450 mm, matrix 512 x 466, effective slice thickness 1.57 mm. Subsequently paramagnetic contrast (gadobenate dimeglumine, Gd-BOPTA, MultiHance, Bracco, Italy) was administered i.v. at a dosage of 0.2 mmol/kg and a flow rate of 3.5 ml/s. After a delay of 75 s, the ‘pre-contrast’ 3D acquisition was repeated with identical imaging parameters. The 3D data set was collected breath-hold in 23 s. In addition to MRC of the colonic wall all patients underwent conventional colonoscopy performed within five to fourteen days following the MR exam.

Results

‘Dark lumen’ MRC, including placement of the rectal tube and colonic filling with warm tap water was well-tolerated by all subjects. Six polyps ranging in diameter between 7 and 12 mm were detected with ‘dark lumen’ MRC (Fig 1). All lesions were confirmed by conventional colonoscopy and subsequent polypectomy was performed. There were no false negative findings. The intravenous administration of paramagnetic contrast resulted in an average SNR increase within the colonic wall of 170% from 9.2 to 24.8. This difference was statistically significant (p<0.001). Polyps revealed even more enhancement with signal intensities increasing by 306% from 8.9 to 36.1 ± 3.9. Lack of contrast enhancement correctly identified three bright 'lesions' as residual stool (Fig 2). In addition, ‘dark lumen’ contrast-enhanced MRC revealed four extraintestinal lesions: two renal cysts in two patients, a single hepatic hemangio (in one patient, and an aortic abdominal aneurysm measuring 4 cm in diameter in another patient.

Discussion

‘Dark lumen’ MR colonography is based on the contrast enhancement of the colonic wall and masses arising from it. Compared to ‘bright lumen’ MRC, the technique appears to enhance diagnostic accuracy and confidence, because the differentiation between polyps and false positive ‘lesions’ like residual stool and air bubbles is more reliable. In addition, dark lumen MRC reduces contrast costs, and decreases data acquisition as well as post-processing times.

Fig. 1: 49-year-old woman referred for MRC and conventional colonoscopy due to positive occult fecal blood test. 10 mm polyp could be detected in the ascending colon based on the contrast uptake (on the right, arrow) compared to the corresponding native sequence shown in the left image (arrow). Diagnosis was confirmed by conventional colonoscopy.

Fig. 2: 61-year-old female patient undergoing MRC for colorectal cancer screening. Polyp-simulating protrusion in the sigmoid colon (on the right, arrow) turned out to be residual stool because of the same signal intensity as compared to native scan (on the left, arrow). Subsequent conventional colonoscopy confirmed absence of colorectal pathologies.

References