1354

Abnormal postprandial response of ascending colon volume in patients with Irritable bowel syndrome with diarrhoea

Susan E Pritchard[1], Luca Marciani[2], Klara C Garsed[3], Caroline L Hoad[1], Wanvipa Thongborisute[2], Emily Roberts[2], Robin C Spiller[2,3], and Penny A Gowland[1]

[1]Sir Peter Mansfield Magnetic Resonance Centre, University of Nottingham, Nottingham, United Kingdom, [2]Nottingham Digestive Diseases Centre, School of Clinical Sciences, University of Nottingham, United Kingdom, [3]Nottingham Digestive Diseases Biomedical Research Unit, University of Nottingham, Nottingham, United Kingdom

Introduction Previous measurements of colon volumes have relied on tests which were either invasive or used ionising radiation [1,2,3,4,5,6,7]. We aimed to measure non-invasively regional colonic volumes in healthy volunteers (HV) and patients with irritable bowel syndrome with diarrhoea (IBS-D) using MRI.

Method 75 HVs and 25 IBS-D patients participated in this study. All subjects were scanned in the fasted state. 35 of the HV and all 25 IBS-D subjects consumed a standard rice pudding meal (362 kcal energy 10% from fat, 81% from carbohydrate and 9% from protein) and post-prandial MRI data was obtained at intervals over 225 minutes. MRI of the supine abdomen was performed using a 1.5 T Philips Achieva MRI scanner with a SENSE 4-element body coil using the following sequences:

1. A coronal dual echo fast field echo (FFE) sequence (24 contiguous slices centred mid-abdomen with TE=2.3/4.6 ms, TR=158 ms, in-plane resolution 1.76 mm × 1.76 mm, slice thickness of 7 mm, SENSE factor=2) during an expiration breath hold of 13s. This sequence provided two images with different contrasts, with fat/water signals out-of–phase and in-phase respectively.
2. A transverse dual echo FFE sequence (45 contiguous slices centred mid-abdomen with TE=2.3/4.6 ms, TR=296 ms with in-plane resolution 1.76 mm × 1.76 mm, slice thickness 7mm, SENSE factor=2) under a 20 s expiration breath hold.

The subjects spent only a few minutes per time point inside the scanner and, if fed, they were asked to spend the rest of the time sitting upright in an adjacent room. The colonic regions were manually segmented using Analyze9^{TM} software (Mayo Foundation, Rochester, MN), simultaneously displaying both coronal dual echo images (Fig.1). The colon wall was usually well delineated in the out-of-phase data, due to the surrounding fat. However, given the variation and heterogeneity of colonic chyme MR properties the in-phase echo sometimes provided better discrimination of colon from surrounding small bowel and this advantage was exploited *ad hoc* by the operator to ease manual segmentation of the differing colonic regions. The transverse images provided additional information on adjacent structures if coronal images were ambiguous.

Results Colonic regions were successfully identified and segmented on each image slice (Fig. 1) and 3D maps from caecum to sigmoid flexure were defined (taking approximately 20 minutes analysis per 3D map). Fasted regional volumes showed wide variation in both HVs being (mean±SD) ascending colon (AC) 203±75ml, transverse (TC) 198±79ml and descending (DC) 160±86ml with no difference from IBS-D subjects (AC 205±69ml, TC 232±100ml and DC 151±71ml respectively).

The AC volume (Fig. 2) expanded immediately by 10% after feeding in the 35 HV (P=0.007), probably due to postprandial ileo-colonic inflow. A later rise in AC volume occurred from t=90 to t=240 min as the meal residue entered the caecum. In contrast IBS-D subjects showed a much reduced post-prandial response of the AC compared with HVs (P<0.0001) and a greater increase in TC volume after 90 minutes (P=0.02).

Discussion

Our findings suggest impaired relaxation of the ascending colon may contribute to accelerated colonic transit and symptoms in IBS-D. This technique provides a non-invasive method for assessing colon form and as such has the potential to provide biomarkers of colonic function that can be used in healthy and disease states. These will be extremely valuable in stratifying patients and evaluating both pharmacological and dietary methods of managing disease.

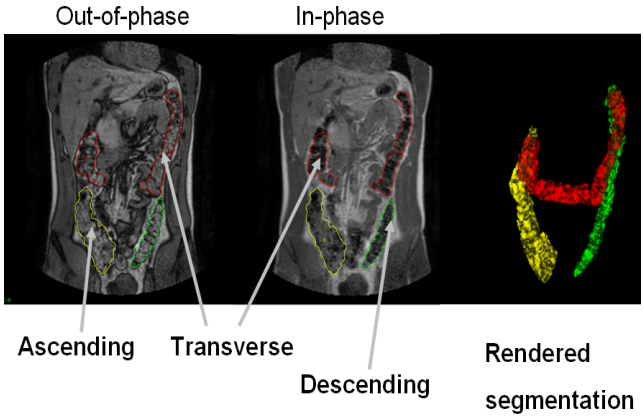

Fig.1 Dual Echo images and segmentation (yellow= ascending colon, red=transverse colon, green = descending colon).

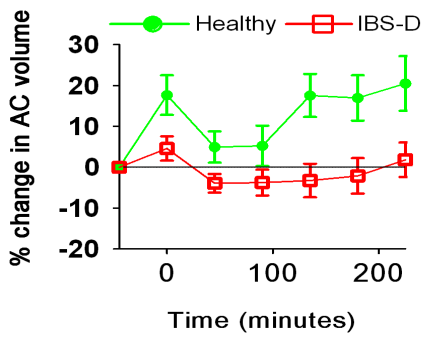

Fig. 2 Change in ascending colon volume Post feeding

References

1.Underhill BML. *Br Med J* 1955; **2**: 1243-1246. 2.Hounnou G, Destrieux C, Desme J, Bertrand P, Velut S. *Surg Radiol Anat* 2002; **24**: 290-294. 3.Saunders BP, Masaki T, Sawada T, Halligan S, Phillips RKS, Muto T. *Int J Colorectal Dis* 1995; **10**: 216-221. 4.Sadahiro S, Ohmura T, Yamada Y, Saito T, Taki Y. *Surg Radiol Anat* 1992; **14**: 251-257. 5.Khashab MA, Pickhardt PJ, Kim DH, Rex DK. *Endoscopy* 2009; **41**: 674-678. 6.Bourgouin S, Bege T, Lalonde N, *et al. J Surg Res* 2012; **178**: 172-180. 7.Perkins AC, Mann C, Wilson CG. 3- *Eur J Nucl Med* 1995; **22**: 1035-1038.

Acknowledgements: NIHR Biomedical Research Unit.