Experimental stress constricts small bowel and increases ascending colon volume in healthy subjects

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Background: Symptoms of irritable bowel syndrome (IBS) are frequently reported to be exacerbated by stress (1-3). Previous animal studies suggest that Corticotrophin Releasing Hormone (CRH) delays gastric emptying and accelerates colonic transit (4). We have previously shown that stressed IBS patients with diarrhoea have constricted small bowels (5) (6) with an acceleration of oro-caecal transit which correlated with their anxiety levels and we have demonstrated an impaired postprandial expansion of the ascending colon in IBS-D patients compared to healthy volunteers. (7). This study investigates the effect of stress on lower GI function in healthy volunteers.

Methods: Two groups of 18 healthy volunteers were exposed to experimental stressors – one group had a painful stimulus (repeated hand immersion in ice-cold water versus a control immersion in warm water) and the other group a pharmaceutical intervention (injection of 100 micrograms corticorelin trifluoroacetate cortisol releasing hormone (CRH) versus a saline control). Salivary cortisol (a marker of stress), symptoms and MRI measurements of small bowel water content and colonic volume were made pre- and post-prandially and subsequently at 45 minute intervals over 270 minutes. Colonic volumes were manually segmented (using Analyze9^{TM} software (Mayo Foundation, Rochester, MN)) from coronal dual-echo, FFE sequence (24 contiguous slices with TE=2.3/4.6 ms TR=158 ms, acquired voxel size 1.76 × 1.76 × 7 mm, SENSE=2) during an expiration breath hold of 13s. Small bowel water content (SBWC) was imaged using a single shot fast spin echo sequence (24 contiguous slices with acquired voxel size 1.56 × 2.83 × 7 mm- interpolated to 0.78 × 0.78 × 7 mm) during an expiration breath hold of 24 seconds. SBWC was measured using custom-written software in IDL® (Research Systems Boulder, CO). The intensity threshold for free water was determined from spinal fluid, and all voxels above this threshold were assumed to be water. Gallbladder, bladder, stomach and blood vessels were manually removed from the analysis to leave only water contained in the small bowel.

Results: CRH produced a significant rise in salivary cortisol levels compared with saline (p=0.004). Ice cold water immersion caused considerable hand discomfort but failed to increase salivary cortisol. Small bowel water content was significantly reduced by both stressors (Fig. 1 A and B) but CRH caused a greater effect (ANOVA p=0.003 versus p=0.02). Ascending colon volume was greater after CRH injection compared with saline (ANOVA p=0.002) (Fig. 1 C and D) but no significant differences were seen with ice versus warm water. Post-intervention sensations of distension were significantly greater for CRH vs saline (p=0.043 Wilcoxon matched pairs signed rank test) but not significantly greater ice vs warm.

Conclusions.Two experimental stressors were shown to constrict the small bowel, mimicking the effect previously seen in IBS-D patients. CRH increased the volume of the ascending colon and also reduced the normal post-prandial increase, possibly due to impaired accommodation. We suggest that stress accelerates transfer of ileal contents from the small bowel to the ascending colon possibly leading to the perceived increase in distension and fullness reported by the subjects.

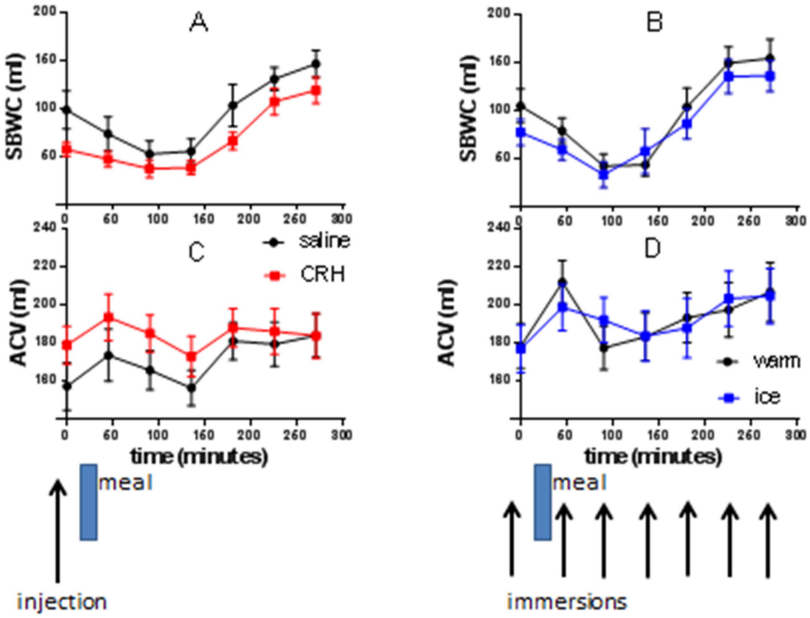

Fig1: (A) SBWC vs time CRH/saline (B) SBWC vs time ice/warm (C) ACV vs time CRH/saline (D) AVC vs time ice/warm

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