

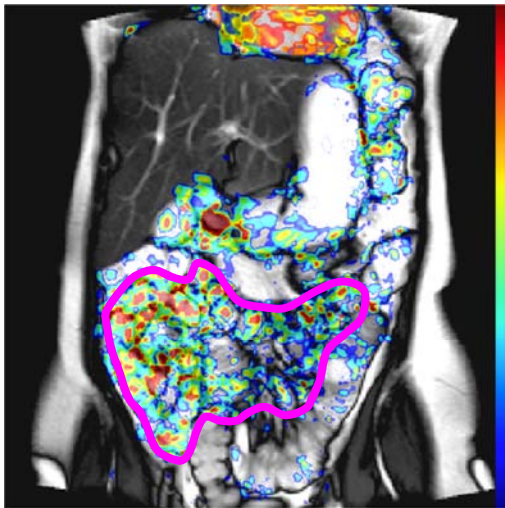
## Changes in Global small bowel motility in response to inflammation in Crohn's disease

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### Purpose:

In small preliminary studies, it has been postulated that normal small bowel motility is inhibited by inflammatory activity related to ileal Crohn's disease<sup>1</sup>(CD). In this prospective study of 72 Crohn's disease patients, we investigate the relationship between global small bowel motility assessed using MRI with post-processing and overall inflammatory burden as measured by faecal calprotectin (fC).



**Fig 1.** Small bowel motility map with 'global' ROI (purple). Each pixel is the SD of the determinant of its Jacobian; red = faster, blue = slower.

### Methods:

**Study overview:** CD activity was assessed by fC (PhiCal, NovaTec) – a marker of luminal inflammation in the GI tract. We then assessed motility by 1) measuring global motility 2) measuring global motility variance and 3) by counting segmental contraction rate.

**Patients:** 71 (median age 33, range 16-78)) patients with Crohn's disease were prospectively recruited for this study. Median disease duration was 6 years (range 0 to 32). 35 of the cohort had ileocolonic disease, 23 and 13 had isolated colonic and small bowel disease respectively, 30 subjects had previously undergone surgery.

**MRI Protocol:** Patients fasted for 4h then drank between 1 and 1.5L of 2% Mannitol at a steady rate over the 45 mins before their scan. Motility Studies were performed on either a 1.5T Siemens Avanto (TrueFISP, TR=3.85ms, TE=1.93ms, image matrix 256x184) or 3T Philips Achieva (Philips: BTFE, TR=1.96, TE=0.98, image matrix 200x167). Slice thickness was 10mm & temporal resolution was 1 image/second on both machines. Sequential motility blocks were performed during to encompass the whole small bowel volume

**Motility analysis:** A modified 2D optic-flow technique was used to register the dynamic time-series data for each slice through the abdominal volume<sup>2</sup>.

The deformation fields

generated by the registration process were used to provide a motility metric expressed as the standard deviation of pixel's Jacobian (a measure of local area change) under a user defined ROI, placed to include all the small bowel visible on the slice. This was 1) averaged across all slices to provide a mean motility score<sup>3</sup> and 2) used to calculate variance in motility across each subjects' small bowel volume. In addition, a linear ROI was placed across bowel lumen (from bowel wall to bowel wall) in segments in the left lower quadrant remote from any demonstrable small bowel Crohns used to 3) calculate contraction frequency, defined as a contraction of >10% of SB diameter expressed as contractions per minute (CPM).

**Statistics:** Calprotectin (ug/g) was correlated against average global motility (A.U), global variance (A.U) and contraction rate (CPM) using Spearman's Rank correlation.

### Results:

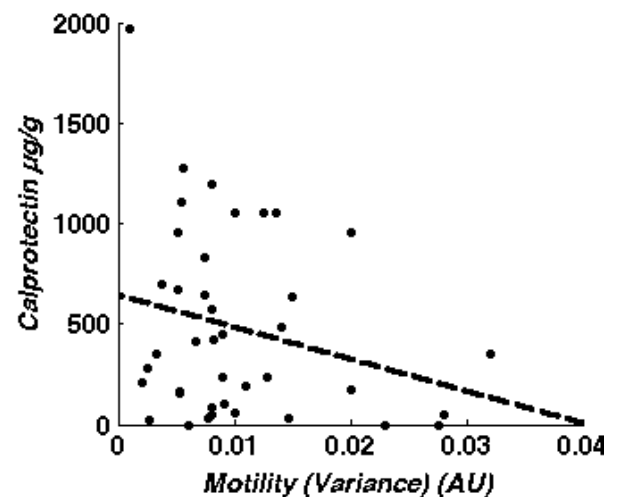
Mean fC score was 398ug/g (range 0 to 1970ug/g) and correlated as follows:

- 1) mean global motility score 0.3A.U (range 0.15 to 0.5), Spearman's Rho = -0.02, P = 0.88
- 2) mean global variance score 0.012A.U range (0.001 to 0.338), Spearman's **Rho = -0.36, P = 0.026** (Fig 2)
- 3) mean contraction rate was 5CPM (range 0 to 8), Spearman's Rho = 0.02, P = 0.84

### Discussion and Conclusion

We found weak non-significant correlations between mean bowel motility and fC, contrasting to previous pilot work<sup>1</sup>. We however found significant negative correlation between fC and variance in the motility score. This suggests inflammatory burden may produce derangement in the coordination of motility across the bowel, possibly reducing the magnitude of normal intrinsic regional variation. Interestingly the data provides a new and potentially interesting avenue to explore with respect to motility heterogeneity in global bowel assessment in disease.

**References:** 1) Bickelhaupt et al. CD: SB Motility impairment... JGM 2013;25(6):467-73, 2) Odille et al. Quantitative assessment ... MRM 2012;68(3):783-93, 3) Menys et al. Global assesment ... Radiol. 2013;269(2):443-50. *Funding received by NIHR-BRC*



**Fig 2.** Correlation between calprotectin and motility variance across SB.