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Correlation between morphological expansion and impairment of intra- and prelesionary motility in inflammatory small bowel lesions in patients with Crohn's disease – Preliminary data

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ABSTRACT

Introduction: The aim of this study is to investigate if alterations of intra- and prelesionary motility in inflamed small-bowel segments correlate with length, wall-thickness and prelesionary dilatation of inflammatory small bowel lesions in patients suffering from Crohn's disease assessed with MRI.
Methods and materials: This retrospective IRB approved study included 25 patients (12 males, 18–77y) with inflammatory lesions examined using (MRE) magnetic resonance imaging enterography. Cine MRE was performed using a coronal 2D steady-state free precession sequence (TR 2.9, TE 1.25) on a 1.5T MRI scanner. Small bowel motility was examined using a dedicated MR-motility assessment software (Motasso, Vers. 1.0, Sohard AG, Bern, Switzerland). Motility patterns (contraction frequency, relative occlusion rate and mean diameter) were assessed in correlation to wall thickness, length and prelesionary dilatation of the lesions. Statistical analysis was performed by calculation of the Pearson's-Correlation coefficient.
Results: The length of the inflammatory segments, the wall thickening and prelesionary dilatation did not correlate with the frequency of the contractions ($r = 0.17$, $p = 0.477$; $r = 0.316$, $p = 0.123$; $r = 0.161$, $p = 0.441$) or the impairment of luminal occlusion ($r = 0.274$, $p = 0.184$; $r = 0.199$, $p = .0339$; $r = 0.015$, $p = 0.945$) and only the prelesionary dilatation ($r = 0.410$, $p = 0.042$) correlated to the mean luminal diameter of the segment.
Conclusion: The degree of motility impairment within inflammatory small bowel lesions does not significantly correlate with the extent of the lesion but with the motility measured in prelesionary, non-affected segments, suggesting an interdependent functional aspect of inflammation even in morphologically non-affected small bowel segments.

1. Introduction

Crohn's disease is characterized by chronic relapsing inflammatory lesions affecting the intestinal tract from oral to anal with predominant occurrence in the small bowel [1]. Lesions may typically develop on a segmental level presenting a skip-lesion pattern with unaffected small-bowel segments next to those affected by the disease. New inflammatory lesions commonly develop in the active phase of the chronic disease presenting either with subclinical, subtle or heavy impairment of the patient's general status [2,3]. The relapsing course of the disease urges the patients for repetitive radiological and clinical examinations to monitor disease activity and to diagnose active flares as the lesion might initially develop from submucosal lymphoid follicles and Peyer's patches that are undergoing hyperplasia followed by chronic suppuration and ulceration that can progress to transmural inflammation with the consecutive development of chronic fibrotic changes and stenosis [4–8].

MR imaging has established as an important imaging modality used to monitor patients suffering from Crohn's disease with small bowel affection to evaluate the presence and severity of inflammatory lesions due to the excellent soft tissue contrast and the lack of ionizing radiation that is especially of importance in younger patients [6]. The technique allows assessing intraluminal, transluminal and extraluminal disease in these patients. It can further be used as well to examine functional alterations of the intestinal tract such as changes of motility patterns [9–13]. The use of motility examinations has been suggested to serve as a biomarker of disease

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Table 1
Overview of the patients' demographics.

$n = 25$	Number	Mean age (y)	Range (y)
Male	12	39.0 (SD ± 15)	26–77
Female	13	41.15 (SD ± 17)	18–67

Abbreviations: y = years, SD = standard deviation, n = number of patients.

activity that correlates with the degree of inflammatory involvement of the small bowel that further adds up in the detection of small bowel lesions [14–16].

Recent studies have shown that motility patterns are locally altered in small bowel segments showing inflammatory lesions [15]. Yet the severity of the lesions may vary from only mucosal inflammation up to transmural and extraluminal inflammation potentially resulting in a complete stenosis and/or stricture of the affected small bowel segment, with the latter known to show distinct alterations of motility in the segments proximal to the lesion [15,17]. Yet the interdependence between the morphological appearance, as assessed using MRI, and the functional alteration within and proximal to the inflammatory lesion are barely investigated. This is of clinical interest as patients with active Crohn's disease often show abdominal complaints though presenting only minor inflammatory lesions. These complaints could partially be explained by motility alterations as it has been suggested that motility alterations might occur as well in non-affected small bowel segments during active Crohn's disease [12]. Common clinical denominators in MRI include the description of lesion length and wall thickening as potentially correlating with inflammation. The goal of our study was to investigate whether these conventional MRI characteristics of small bowel lesions correlate with the functional alteration of the affected segments thus if the extent of changes of motility patterns correlates with lesion length, wall thickening and prelesionary dilatation and to investigate if the function of prelesionary, non-affected small bowel segments correlate with the intralesionary impairment of small bowel motility.

2. Methods and materials

2.1. Patients

The Institutional and Governmental Ethics Committee approved the protocol of this retrospective study waiving the need for informed consent.

A total of 25 patients were included in this retrospective study from 06/2011 to 09/2012. The study group consisted of 12 males with a mean age of 39.0 years (range 26–77y) and 13 females with a mean age of 41.15 years (range 18–67y). The mean time since confirmed diagnosis of CD in our study population was 9.75 years (range 1–29y). All patients received their regular anti-inflammatory medication, while no patient was under opioid therapy. 19/25 patients had their inflammatory lesions in the terminal ileum, 6/25 patients presented with the lesion apart of the terminal ileum in the small intestine (Fig. 1a, Tables 1 and 2a). The Vienna and Montreal-Classification is given in Table 2b.

Inclusion criteria were histologically proven Crohn's disease, clinical indication for small bowel MRI and the MRI examination revealing pathological small-bowel segments presenting with inflammatory morphological changes related to Crohn's disease as previously described [18].

3. MRI imaging

Preparation: Prior to MRI all participants were asked to fast for at least 4 h and to ingest 1000 mL of a preparation solution containing 3% nonabsorbable mannitol to provide sufficient distension and contrast of the small intestine as previously described. Every participant was instructed to drink this solution continuously over a period of one hour prior to the exam.

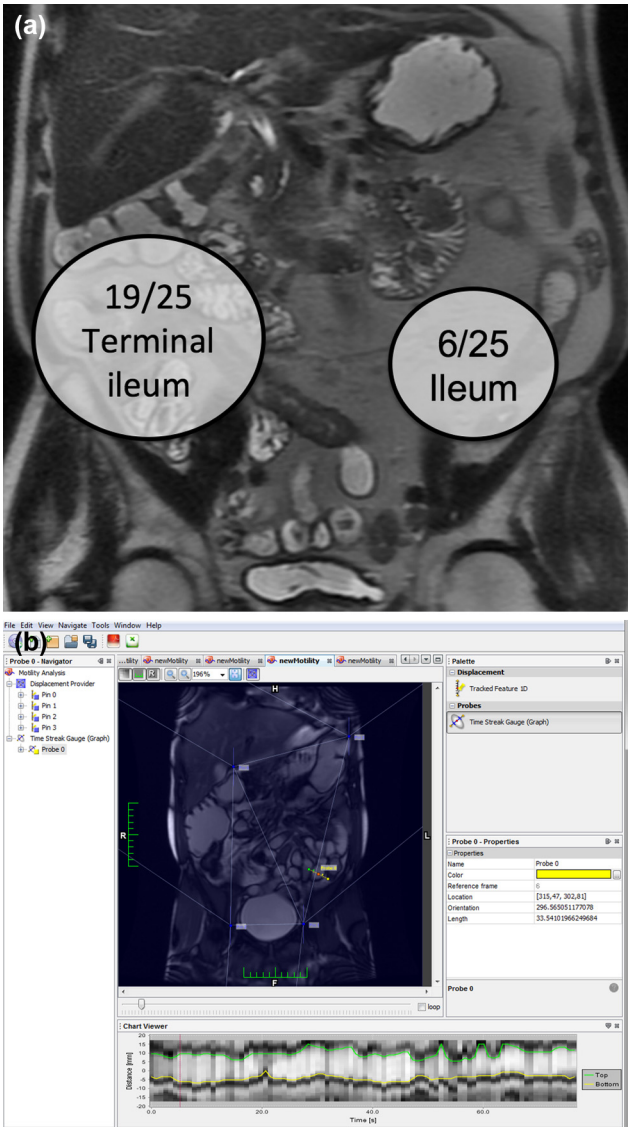

Fig. 1. (a) Distribution of the segmental inflammation in the study population. (b) Motasso-Software interface. The figure demonstrates the MRI-sequence showing the motility in the middle of the interface with the resulting small bowel motility analysis used to plot the motility curve underneath.

Table 2a
Clinical presentation of the included study population illustrating location and duration of the disease.

Parameter	Number of patients
Disease duration (years)	
Less than 1	2
Between 1 and 5	9
Between 6 and 10	2
Over 10	12
Localization of the analyzed inflamed segments	
Terminal ileum (±caecum)*	19
Other parts of small bowel	6

* Terminal ileum <10 cm upstream the ileocolonic junction.

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