

# Quantitative assessment of bowel motility in healthy individuals and patients with organic small bowel disease using MR cine -Initial Experiences

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**Target audience:** Clinicians interested in assessment of small bowel motility function using non-invasive or ionizing methods.

**Purpose:** The objective of this study is to compare the quantitative parameters of small bowel motility provided by dynamic MRI between healthy volunteers and patients with small bowel diseases in order to determine the characteristics of normal and different patterns of impaired bowel peristalsis.

**Materials and Methods:** 24 healthy volunteers (8 male, 14 female; mean age, 25 years; range, 19-50 years) and 12 patients with organic small bowel disease in our hospital were included in this IRB-approved, prospective study. Imaging was performed using a 3.0T scanner at 75 minutes after a standardized oral administration of 1500ml non-absorbable fluid (mannitol, 2.5%), a serial coronal scan consisting of 200 images was obtained at the selected plane in 114 seconds without breath-hold. Time-caliber curve was plotted at two well distended small bowel loops in both healthy and patients groups regardless of the location. Maximum luminal diameter (MLD), maximum amplitude of contraction (MAC), average time of contraction (ATC), maximum number of consecutive contractions (MCC) and duration of pause (DP) were measured on basis of the graph. Characteristics of abnormal peristaltic parameters in different patients were assessed in comparison to normal curves of healthy volunteers.

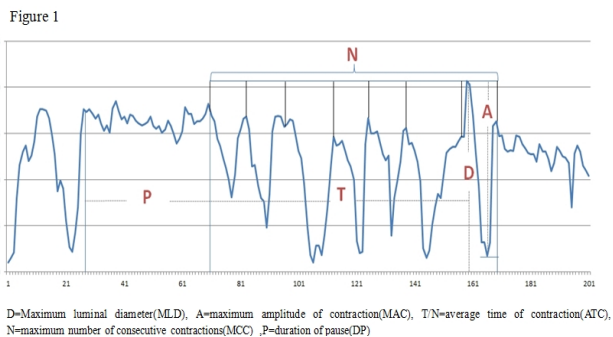
**Results:** MLD, MAC, ATC, MCC were normally distributed in healthy individuals. There were no statistical differences in MLD, MAC, ATC, MCC and DP between two selected bowel segments in healthy groups. In comparison to healthy groups, 10/24 (41.7%) dilated bowel segments, 4/24 (16.7%) segments with paralyzed bowel motility, and 5/24 (20.8%) segments with continuous contractions were detected in patients group.

**Discussion:** Characteristics of bowel motility in healthy individuals and patients with organic small bowel diseases can be quantitatively assessed on the basis of MR cine imaging. For patients with organic small bowel diseases, MLD, MAC, ATC, MCC and DP value can be used to describe different patterns of bowel dysmotility which correlated to specific pathophysiological status of local bowel segment.

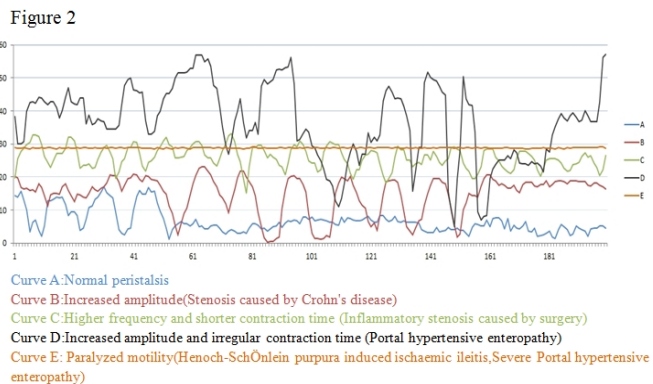
**Conclusion:** Time-caliber curve combined with quantitative data provided by dynamic cine MRI can be used for assessment of small bowel motility function in healthy individuals and patients with organic small bowel diseases. These findings support the role of small bowel motility in the pathophysiological triad of specific small bowel disease and its relevance to clinical symptoms.

**References:** 1. Froehlich J M, Patak M A, von Weymarn C, et al. Small bowel motility assessment with magnetic resonance imaging. *J Magn Reson Imaging* 2005;21;370-5. 2. Wakamiya M, Furukawa A,

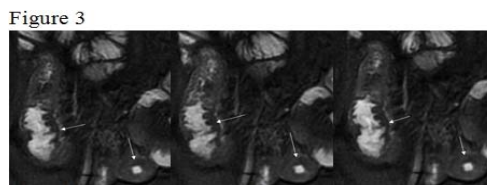
Kanasaki S, et al. Assessment of small bowel motility function with cine-MRI using balanced steady-state free precession sequence. *J Magn Reson Imaging*. 2011;33(5):1235-40.



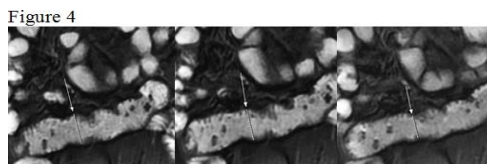
D=Maximum luminal diameter(MLD), A=maximum amplitude of contraction(MAC), T/N=average time of contraction(ATC), N=maximum number of consecutive contractions(MCC), P=duration of pause(DP)



Curve A: Normal peristalsis  
Curve B: Increased amplitude (Stenosis caused by Crohn's disease)  
Curve C: Higher frequency and shorter contraction time (Inflammatory stenosis caused by surgery)  
Curve D: Increased amplitude and irregular contraction time (Portal hypertensive enteropathy)  
Curve E: Paralyzed motility (Henoch-Schönlein purpura induced ischaemic ileitis, Severe Portal hypertensive enteropathy)



Paralyzed motility in patients with Henoch-Schönlein purpura induced ischaemic ileitis



Higher frequency and shorter contraction time in patients with inflammatory stenosis caused by surgery