Selective Visualization of Hypokinetic Small Bowel Loop Using Low b Value EPI

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Purpose/Introduction: Generally, DWI uses large motion probing gradients (MPG) which detects IVIM as degree of signal decrease. If small MPG was applied, larger random motion such as perfusion affects image contrast. On the other hand, the authors apply cine MRI for diagnosis of strangulated small bowel obstruction (SBO). It is useful in detecting strangulated loop which shows impaired peristalsis. Our hypothesis is that strangulated SBO without significant peristalsis yields good signal preserve with weak MPG (i.e., on low b value image), while surrounding normal loop with active peristalsis shows poor signal preserve.

Subjects and Methods:

A 1.5 Tesla superconducting unit (Gyroscan Intera) was used in this study. Cine MRI and low b value EPI (b=0, 50 sec/mm^2) were acquired. We conducted volunteer study and clinical case study. Volunteer study includes five volunteers (All men; Age ranged 28-44 y/o, mean 32 y/o). 1L of green tea was administered orally prior to MRI. Signal preserved ratio (SPR%: (SI b=50) / (SI b=0) x 100) between pre and post i.v. administration of anti-cholinergic agent (Buscopan) was measured. We use SPR as an indicator instead of ADC because 1) ADC is not sensitive in range of large SPR value and 2) SPR is suitable for visual evaluation. Clinical case study includes 14 cases with SBO (8 men and 6 women; Age ranged 24-79 y/o, mean 58 y/o). We measured three part of SPR in (1) closed loop if the patient have, (2) proximal to obstructive site, (3) normal loop.

Results:

In normal volunteer, SPRs prior / after Buscopan were 41 and 74 %, respectively.

The results in clinical study are summarized in Table 1. We could not measure SPR in all of these points. For example, in some cases, normal loop was not dilated or the course of proximal loop was indeterminate. Total number of measured points was 27 locations. Closed loop with strangulation showed the largest SPR (83%). Non-strangulated loop near by obstructive site was followed (57%), and normal loop showed much less value (30%). Typical images are shown in Figure 1.

Conclusion:

1) Low b value EPI could visualize strangulated loop and non-strangulated loop closed to obstructive site and suppressed the signal from surrounded normal loop. 2) Signal preserved ratio (SPR) may reflect peristaltic motion of small bowel loop. 3) Signal preserved ratio (SPR) greater or equal to 80% may highly suggestive of strangulated SBO.

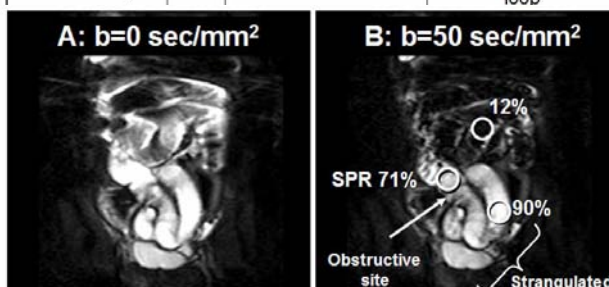| Location	n*	Signal Preserved Ratio % (mean)	Final Diagnosis**
Closed loop	6	**83 ± 9**	**Strangulated loop**
Closed loop	1	27	Non-Strangulated loop
Proximal to Obstructed Site	7	57 ± 19	Non-Strangulated loop
Normal loop	13	30 ± 16	Non-Strangulated loop

Table 1: Signal preserved ratio of measured location in small bowel. Strangulated loop showed very high signal preserved ratio. On the other hand, non-strangulated loop showed lower value except for these in just proximal to obstructed site.

Figure 1: A 52 year-old woman with strangulated SBO. Signal preserved ratio in closed and strangulated loop was 90%. On the other hand, distal loop from obstructive site was 12 %.