Preoperative Assessment for Pelvic Adhesions: Value of Multi-phase and Multi-slice Kinematic FIESTA Imaging

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Purpose

In our previous study, we demonstrated that multi-phase and multi-slice kinematic single-shot fast spin-echo (SSFSE) imaging might provide useful information in order to evaluate pelvic adhesions. However, SSFSE imaging has some disadvantages such as poor image quality and low contrast-to-noise ratio. As improvements of software and hardware enables to use short repetition time, and 90 degree flip angle without limitation of the specific absorption rate, 2D steady-state Free Precession (FIESTA) sequence provides good image quality with high signal-to-noise ratio within a second per slice. Therefore, we tried to apply fat-saturated FIESTA sequence to kinematic imaging.

Materials and methods

This study included 29 female patients with gynecologic disorders who underwent MR imaging (age range 19-70 years old; mean age 43.7 years old) before surgery. MR imaging was performed with a superconducting magnet operating at 1.5T (Signa TwinSpeed Excite HD; General Electric Medical Systems, Milwaukee, WI). All MR images obtained in the sagittal plane with field of view of 35x35 cm by using 8ch body phased array coil. FIESTA imaging was performed with the following parameters: TR/TE: 4.3 msec /minimum time; Flip angle: 90 degree, slice thickness / gap: 4-5mm / 1mm, matrix: 256 x 192, sagittal plane with chemical-shift-selective fat suppression. The acquisition time per slice was approximately half second. One set of 30 images per one phase covered the entire pelvis from the right to the left, and 10 phase acquisitions were repeated under free respiration. The total acquisition time was five minutes for 300 images. All images were sorted according to location and, at each location, images were sorted according to time. Then, all images were sequentially and repeatedly displayed on a monitor in cine mode at a frame rate of 10 frames per second.

Evaluations: We classified the patterns of movements of the organs (the ovary, uterus, small intestine, colon, and rectum) against other organs into two types: type 1= independent movement (motions which are independent of those of the adjacent organ), type 2= synchronous movement (moving accordant to the adjacent organ). All of the adherent interfaces were retrospectively correlated with surgical findings. In addition, we determined the presence or absence of peristalsis of the rectum, colon, and small intestine. We defined peristalsis of the intestine on kinematic MR imaging as wave-like contractive motions of the intestinal wall on the display.

Exclusions criteria: The first exclusion from evaluations was that the target organs were not identified on FIESTA images. The second exclusion was that locations of the target organs were apparently apart from each other.

Results

Verified by surgery: 37 adherent interfaces were verified by surgery (interfaces between rectum and uterus = 5, colon and uterus = 2, small intestine and uterus = 1, right ovary and uterus = 4, left ovary and uterus = 11, right ovary and intestine =5, left ovary and intestine = 9).

Exclusions: 34 interfaces were excluded from evaluations of the MR findings.

1) Eleven ovaries (six right ovaries and five left ovaries), which were not detected on FIESTA images alone, were excluded. Resultantly twenty-two interfaces of the ovary to the uterus and intestine were excluded.

2) Twelve interfaces that were apparently apart from each other (one interface between the small intestine and the uterus, four interfaces between the colon and the uterus, three interfaces between the right ovary and the uterus, two interfaces between the right ovary and the colon, one interface between the left ovary and the colon, one interface between the left ovary and the uterus).

MR findings: Of the total 203 interfaces, 169 (83.3%) in 29 patients were evaluated. 34 interfaces of 169 evaluated interfaces (20.1%) have adhesions. Table 1 summarizes the relations between kinematic MR findings and surgical results. When the finding of independent movement and that of synchronous movement were regarded as negative and positive findings of adhesions, respectively, negative and positive predictive values, sensitivity, specificity, and accuracy were 97.7%, 83.8%, 91.2%, 95.6%, and 94.7%, respectively. The wave-like movements of the intestine were recognized on the display. Existence of peristalsis was observed in all of 29 patients (100%).

Discussion and Conclusion

In our previous report, the result about evaluation of pelvic adhesions on kinematic SSFSE imaging was that negative and positive predictive values, sensitivity, specificity, and accuracy were 95.7%, 54.7%, 72.5%, 87.4%, and 85.4%, respectively. We speculated the reason why kinematic FIESTA imaging provided more information than SSFSE imaging is that FIESTA imaging has higher special resolution, signal-to-noise ratio, and better image quality, such as blurring, than SSFSE imaging.

Table 1. Relationship between kinematic MR findings and surgical results

	Type 1		Type 2	
Adhesions	no	yes	no	yes
Interfaces between				
Rectum and uterus	20	2	2	5
Colon and uterus	22	0	3	3
Small intestine and uterus	26	0	1	1
Right ovary and uterus	18	0	0	2
Left ovary and uterus	11	0	1	11
Right ovary and intestine	18	0	1	2
Left ovary and intestine	14	1	1	7
Overall	129	3	6	31

Note. - The type is on a MR finding of type 1 (independent movement), and type 2 (synchronous movement).