

# EVALUATION OF UTERINE PERISTALSIS AT CORONAL PLANE OF CINE MRI: COMPARISON WITH SAGITTAL PLANE AND CORRELATION WITH OVULATION SIDE

Fuki Shitano<sup>1</sup>, Aki Kido<sup>1</sup>, Masako Kataoka<sup>1</sup>, Koji Fujimoto<sup>1</sup>, Kayo Kiguchi<sup>1</sup>, Kyoko Takakura<sup>1</sup>, Yuki Himoto<sup>1</sup>, and Kaori Togashi<sup>1</sup>  
<sup>1</sup>Department of Diagnostic Imaging and Nuclear Medicine, Graduate School of Medicine, Kyoto University, Kyoto, Kyoto, Japan

**Target Audience:** Clinical radiologists and gynecologists who are interested in uterine function.

**Introduction:** Uterine peristalsis is a rhythmic and subtle stripping movement in the subendometrial myometrial junction. This movement is closely related with early stages of reproduction and diseases. This movement has been visualized and evaluated by using trans-vaginal ultrasonography<sup>[1]</sup> and MRI<sup>[2]</sup>. As for MRI, it was evaluated only at sagittal plane of cine MRI. Considering the sperm transportation that is carried from uterine cervix to one side of tube with the dominant follicle<sup>[3]</sup>, coronal plane of the uterus may give more information about the relation between peristaltic movement and ovulation. The purpose of this study is to compare the uterine peristalsis with two planes, sagittal and coronal plane of the uterus, and evaluate better visualization of uterine peristalsis and the relation between peristalsis and laterality of ovulation.

**Materlas and Methods:** A total of 25 female volunteers in reproductive ages (age range: 23-44 years; mean: 31.1 years) were recruited. MRI studies were performed in late luteal and peri-ovulatory phase. Among 25 studies, 2 studies were excluded due to taking an emergency contraceptive pill (n=1) and submucosal uterine leiomyoma on MR imaging (n=1). As a result, 23 studies were included in the study. MR studies were obtained using a 3.0-T magnet unit (Toshiba Medical Systems, Tokyo, Japan) with a phased-array coil. To obtain cine MR imaging, under quiet respiration, a total of 60 serial images were obtained by FASE (fast advanced spin-echo) (TR/TE=3000/80 msec, slice thickness=5mm, matrix =352x256, FA = 90 deg), every 3 seconds over 3 minutes in the mid-sagittal and mid-coronal plane of the uterus. Pre-medication, to include Anti-cholinergic drugs were not administered. The MR images were evaluated independently by two radiologists. Uterine peristalsis was defined based on previously reported findings:

- a) Recognition of wave conduction in the longitudinal axis within the junctional zone
- b) Recognition of endometrial stripping movement

The readers independently evaluated cine MR images in peri-ovulatory phase for the following five findings:

- 1) The presence or absence of peristalsis of anterior and posterior walls in sagittal planes, bilateral walls and fundus in coronal planes
- 2) The direction of the peristaltic waves of each wall in two planes (cervico-fundal, fundo-cervical, bilateral and unknown) and of fundus in coronal planes (right-left, left-right, bilateral and others)
- 3) The frequency of the peristaltic waves in 3 minutes
- 4) The presence or absence of the outer myometrial conduction (OMC) of low signal intensity (Fig.1, 2)
- 5) The frequency of OMC per 3 minutes

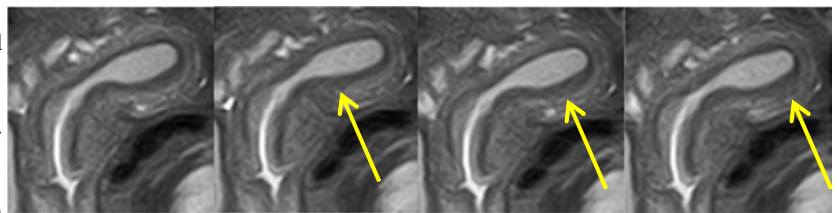


Fig1: OMC in sagittal plane

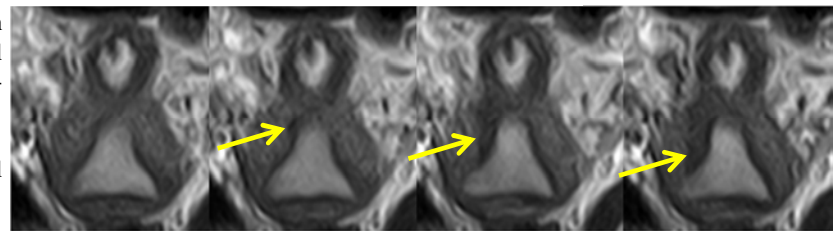


Fig2: OMC in coronal plane

MR images were evaluated at about 10 times faster than real time adjusting speed individually. The presence or absence of corpus luteum and their laterality were determined on axial FASE images in luteal phase in consensus. Statistical analysis was performed using Student's t-test and Fisher's exact test.

**Results:** The results of peristaltic direction, frequency and conduction of OMC were shown on Table 1, 2. Regarding evaluation of uterine fundus at coronal plane, three subjects were excluded because of poor visualization of fundus. There were no significant differences in frequency of peristaltic waves between each walls of sagittal and coronal plane in both readers. In comparison of two planes, cases that peristaltic directions were "unknown" were significantly fewer in coronal plane than sagittal plane (p<0.05). In addition, CF direction was recognized more in coronal plane than sagittal plane (p<0.05). OMC was recognized significantly more subjects in coronal plane (p<0.05). The side of ovulation was suspected only in eleven of 23 subjects. The ovulation side and peristaltic direction were correlated only three of 11 subjects (Table 3).

**Discussion and Conclusions:** From our results, uterine peristalsis can be more easily recognized in coronal plane than sagittal plane, especially cervico-fundal peristalsis with outer myometrial conduction. One of the reasons of this difference may be the feature of uterine movement itself. That is, myometrial contraction may be stronger in bilateral wall than mid-uterine position. On sagittal plane, image plane is placed in mid-uterus that is most distant from the bilateral tubes. Considering the peristaltic function of sperm transportation to bilateral tubes, it may be possible that bilateral conduction is stronger. Regarding the relationship with transportation of sperm and ovulation, more population is necessary to evaluate the relation.

**References:** [1] de Vries, et al. Am J Obstet Gynecol 1990 [2] Nakai A, et al. JMIR 2004 [3] Kunz G, et al. Hum Reprod 1996

| Slice Direction<br>Uterine wall | SAG      |           | COR   |     |      |     |        |     |
|---------------------------------|----------|-----------|-------|-----|------|-----|--------|-----|
|                                 | Anterior | Posterior | Right |     | Left |     | Fundus |     |
| Reader                          | A        | B         | A     | B   | A    | B   | A      | B   |
| Direction                       |          |           |       |     |      |     |        |     |
| CF                              | 9        | 9         | 9     | 12  | 12   | 16  | 12     | 16  |
| FC                              | 4        | 5         | 7     | 7   | 4    | 3   | 3      | 3   |
| Bilateral                       | 7        | 6         | 5     | 2   | 7    | 4   | 8      | 4   |
| Unknown                         | 3        | 3         | 2     | 2   | 0    | 0   | 0      | 0   |
| Frequency (/3min)               | 5.1      | 4.8       | 4.7   | 4.6 | 5.3  | 4.5 | 5.1    | 4.8 |
| Conduction of OMC (+)           | 9        | 9         | 11    | 10  | 16   | 15  | 16     | 14  |
| (-)                             | 14       | 14        | 12    | 13  | 7    | 8   | 7      | 9   |

Table 1: Peristaltic Direction, Frequency and OMC

| Reader    | A  | B  |
|-----------|----|----|
| Direction |    |    |
| RL        | 4  | 4  |
| LR        | 2  | 2  |
| Bilateral | 2  | 2  |
| Other     | 12 | 12 |

Table2: Peristaltic Direction of Coronal plane at Uterine Fundus

| The side of Ovulation | R | L |
|-----------------------|---|---|
| Direction             |   |   |
| RL                    | 0 | 2 |
| LR                    | 1 | 0 |
| Bilateral             | 0 | 0 |
| Other                 | 3 | 5 |
| unknown               | 0 | 1 |

Table3: The Laterality of Ovulation and Peristaltic Direction