Signal intensity changes during physiological movement: comparison of uterine myometrium and myocardium

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Purpose

Cine MR imaging displayed a wave-like conduction in the junctional zone (JZ) during uterine peristalsis. The mechanism of JZ, however, is still unclear. From the histological and functional perspective, uterine smooth muscle and cardiac muscle have some similarities. Therefore, the purpose of this study was to compare uterine myometrium and myocardium on cine MR imaging with wall thickness and signal intensity (SI) measurement.

Materials and Methods

Twelve patients (ten males and two females, age mean 60.0 ranging 32-76) with suspected ischemic heart disease who underwent cardiac MR imaging, and ten patients (ten females, age mean 28.2 ranging 20-35) clinically suspected of having benign pelvic diseases who underwent pelvic MR imaging, were included in this study. Both cardiac and pelvic MR images were obtained using 1.5T system (Intera Master, Philips Medical Systems). The imaging parameter were as follows; (a) cardiac images (left ventricle short and long axis): cine B-TFE (Balanced Turbo Field Echo) with breath holding, sense-cardiac coil, TR/ TE 3.2/1.6, matrix 192 x 256, slice thickness 10mm, FOV 27 cm; (b) pelvic images (uterus, midsagittal plane): cine B-TFE under free breath, sense-body coil, TR/ TE 3.6/1.8, matrix 240 x 256, slice thickness 5mm, FOV 27 cm. From cardiac data sets, we choose one diastolic and systolic short axis image and measured wall thickness of septal and lateral ventricle wall. SI was calculated by drawing ROI over the septal and lateral wall, and back muscle on the same slice. From uterine data sets, we choose two planes that junctional zone seemed thickest and thinnest (JZ thick phase and JZ thin phase). Thickness of anterior and posterior wall of the myometrium (myometrium included junctional zone and outer myometrium) was measured and SI was calculated by drawing ROI over the anterior and posterior myometrium, and back muscle on the same slice. SI rate was calculated from myocardium SI / back muscle SI or uterine myometrium SI/ back muscle SI. Wilcoxon t-test was used for statistical analysis.

Result

The myocardium in diastolic phase was significantly thinner than that in diastolic phase. (septal wall 10.4 mm vs. 14.5 mm, lateral wall 8.48 mm vs. 14.38 mm, $p<0.01$). The SI rate of myocardium in diastolic phase was significantly higher than that in systolic phase (septal wall 3.70 vs. 3.03, lateral wall 4.36 vs. 3.24, $p<0.05$). On the other hand, neither thickness of uterine myometrium (anterior wall 12.8 mm vs. 13.5 mm, posterior wall: 15.2 mm vs. 14.3 mm) nor SI rate (anterior wall 2.77 vs. 3.15, posterior wall 2.63 vs. 3.00) showed no statistical difference between JZ thick and JZ thin phases.

Conclusion

The SI rate of myocardium changed according to wall thickness. Generally, water content is considered as a main factor that increases SI on T2-weighted images and B-TFE images. That is, myocardium is supplied by coronary arteries in diastolic phase which increases water contents, and results high SI rate. On the contrary, SI rate of whole uterine myometrium was stable, though the thickness of JZ changed during uterine peristalsis. Therefore, we suppose arterial supply or water content to uterine myometrium may not dramatically change during uterine peristalsis.

Figures. Left: Cardiac short axis image in diastolic and systolic phase. Right: Uterine sagittal image in JZ thick and thin phase.