

Effect of the anticholinergic agent in the uterus: Size and signal change in the uterine zonal anatomy in fast spin-echo T2-weighted images.

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Introduction:

In the MR imaging of the female pelvis, it is well known that the administration of the anticholinergic agents suppress motion artifacts caused by intestinal motion and improve the overall image quality. Similar to the intestines, the muscular layer of the uterus, or myometrium, consists of smooth muscles, which is responsible for the uterine contraction which appears as low signal intensity areas on T2-weighted images (T2WI) (1, 2).

Adenomyosis and leiomyoma are one of the benign gynecologic diseases commonly seen in the uterine myometrium of the reproductive women. On FSE-T2WI, they typically present as low signal intensity as the inner myometrium or junctional zone, and as lower signal intensity than normal outer myometrium. Therefore it is helpful for the diagnosis of these lesions if the signal of the myometrium increases by the administration of the anticholinergic agents, but the effect of the drug on the appearance of the uterus in FSE-T2WI is still not well described. Our aim is to investigate the effects of the anticholinergic agent on the myometrial contractility by measuring area and signal intensity of each zonal structure of the uterine corpus as well as the contrast between two adjacent layers on FSE-T2WI.

Materials and Methods:

Study population included ten healthy women of reproductive age (29.0 ± 3.5 years). The phase of the menstrual cycle was not considered in this study. Sagittal T2WI was obtained at 3T scanner (Trio; Siemens) utilizing a multi-channel phased array coil (TR/TE=4800/107). Resolution parameters include slice thickness of 3mm, matrix of 512x384, and FOV of 260x195mm. In all subjects, MR images were obtained before and after the intramuscular administration of the anticholinergic agent (20 mg of the hyoscine butylbromide). For the image analysis, areas (cm²) and the averaged signal intensity of the outer, inner layer of the uterine corporeal myometrium, and the endometrium were measured by applying polygonal region of interest (ROI). SNR of each anatomical structure, and CNR of the adjacent layers were calculated by the following formula: $SNR = \text{mean } SI_{\text{tissue}} / SD_{\text{noise}}$, $CNR = |\text{mean } SI_{\text{tissueA}} - \text{mean } SI_{\text{tissueB}}| / SD_{\text{noise}}$. Paired t-tests were performed.

Results:

The area and SNR of each anatomical structure, and CNR of the adjacent layers in pre- and post-administration of the anticholinergic agent are summarized on Table 1. The area and SNR of the outer myometrium was significantly increased after the administration of the anticholinergic agent. There was also significant increase in CNR between the outer myometrium and the JZ.

Discussion and Conclusion:

Anticholinergic agents suppressed myometrial contractility, which resulted in increase in areas and SNR of the outer myometrium. Since differentiation between uterine leiomyomas and focal adenomyosis are not always easy on T2WI based on the clearness of their margin, increased signal intensity of the surrounding outer myometrium and increased contrast between the inner and outer myometrial layers should contribute to lesion conspicuity. Further investigation is required, however, to evaluate actual usefulness of the administration of the anticholinergic agents for the diagnosis of these diseases. In conclusion, our study revealed that the anticholinergic agents have the potential to improve detection and differentiation of the myometrial lesion by reducing uterine contractility in addition to suppression of artifacts by intestinal motion.

		pre	post	p value
<i>area(cm²)</i>	outer myometrium	9.0 ± 3.2	9.9 ± 2.8	<0.05
	JZ	3.9 ± 1.3	3.7 ± 1.5	0.38
	endometrium	2.0 ± 1.2	2.0 ± 1.2	0.97
<i>SNR</i>	outer myometrium	11.8 ± 2.5	12.8 ± 3.1	<0.05
	JZ	9.1 ± 2.0	9.5 ± 2.3	0.17
	endometrium	16.9 ± 3.7	17.6 ± 3.3	0.41
<i>CNR</i>	outer myometrium/JZ	2.7 ± 1.1	3.2 ± 1.3	<0.05
	JZ/endometrium	7.8 ± 2.8	8.0 ± 2.2	0.66

Table 1.

References:

- Hendricks CH. Inherent motility patterns and response characteristics of the nonpregnant human uterus. Am J Obstet Gynecol 1966; 96:824-843.
- Togashi K, Nakai A, Sugimura K. Anatomy and physiology of the female pelvis: MR imaging revisited. 2001;13:842-849.

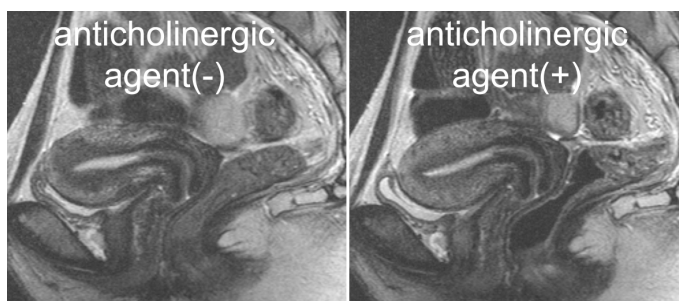


Figure 1. After the administration of the anticholinergic agent, area and SI of the outer myometrium increased and focal low SI area due to contraction, which may mimic focal adenomyosis, disappeared.