Benign Gynecologic Conditions of the Uterus

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KEYWORDS

• Leiomyoma • Fibroid • Adenomyosis • Retained products of conception
• Uterine arteriovenous malformation

KEY POINTS

- Adenomyosis is a common, frequently debilitating condition affecting women in their later reproductive years.
- Uterine leiomyomas are the most common tumor of the uterus, affecting up to 80% of women, and can be a cause of abnormal uterine bleeding, pelvic pain and mass effect, and reproductive or sexual dysfunction.
- Differentiating retained products of conception, a common cause of postpartum hemorrhage, from uterine arteriovenous malformation is important in order to allow for optimal treatment.
- Although ultrasound is the first line imaging modality in evaluation of the uterus, MR imaging has become a useful and reliable noninvasive tool in diagnosis and problem solving in all of these entities.

BACKGROUND

Relevant Uterine Anatomy

The anatomy of the normal, premenopausal uterus is traditionally divided into 2 distinct components: the endometrium and the myometrium. MR imaging has the advantage of further stratifying the anatomic layers into 3 well-depicted zones on T2-weighted imaging (T2WI), as follows (**Fig. 1**):

1. *Endometrium*: It has high signal on T2WI due to the presence of secretions and abundant cytoplasm. In reproductive-aged women, normal endometrial thickness varies between 3 and 6 mm in the proliferative phase and 5 and 13 mm in the secretory phase.
2. *Inner myometrium/junctional zone (JZ)*: This superficial myometrial layer consists of myocytes with a high nuclear-to-cytoplasmic ratio and reduced water content, relative to the deeper myometrial myocytes.[1] This unique morphology results in an intrinsic, lower signal on T2WI. The concentric orientation of smooth muscle fibers, in contrast to the longitudinal arrangement in the outer myometrium, also contributes to the lower signal of the JZ. The JZ is the presumed site of origin of uterine contractions and peristalsis.[2]
3. *Outer myometrium*: The outer myometrium consists of myocytes with a lower nuclear-to-cytoplasmic ratio. The relative increase in water content and the longitudinal orientation of smooth muscle fibers results in a higher T2 signal than the JZ.

Physiologic variation of the JZ may occur with age or with changes in hormone levels. In postmenopausal patients, there is progressive

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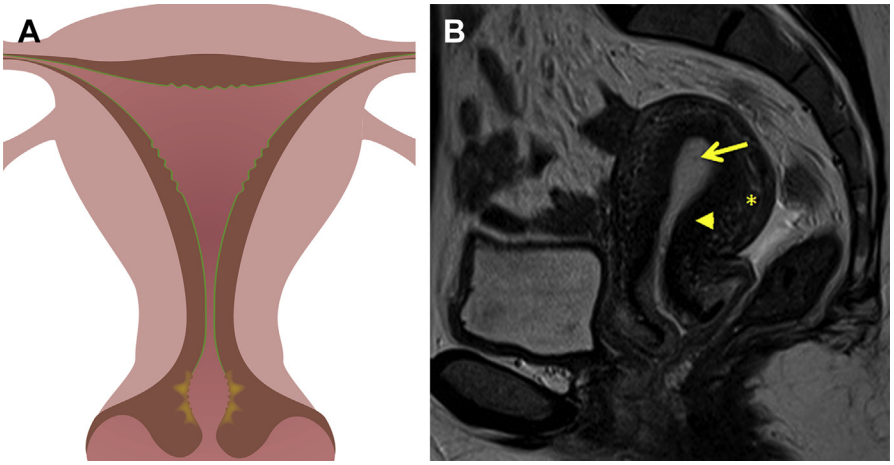

Fig. 1. Zonal anatomy of uterus. (*A*). Endometrial-subendometrial unit of uterus. Endometrial-subendometrial unit is composed of glandular/stromal portion of endometrium (*green*) and stratum subvasculare of myometrium, with predominantly circular muscular fibers (*yellow*). (*B*). Sagittal T2WI demonstrates 3 distinct uterine layers visible on MR imaging: endometrium (*arrow*), JZ (inner myometrium, *arrowhead*), and outer myometrium (*asterisks*). ([*A*] *Courtesy of* Amy N. Thomas, Stanford University; *Modified from* Leyendecker G, Kunz G, Kissler S, et al. Adenomyosis and reproduction. Best Pract Res Clin Obstet Gynecol 2006;20(4):528; with permission.)

dehydration of the outer myometrium, which lowers the T2 signal and, therefore, the distinction between the JZ and outer myometrium.[1] With increasing age, the smooth muscle of the myometrium undergoes progressive atrophy. Therefore, the JZ may not be delineated in up to 30% of postmenopausal patients.[3]

Patient Preparation

Bladder emptying is recommended immediately before the examination in order to reduce artifacts related to bladder filling and patient discomfort.[4] Motion artifacts related to small bowel peristalsis may be minimized using antiperistaltic agents, such as hyoscine butylbromide (20 mg intramuscularly [IM]/intravenously [IV]) or glucagon (0.5–1.0 mg IM/IV). Routine use of antiperistaltic agents in pelvic MR imaging has been shown to significantly improve image quality.[5]

MR Imaging Protocol

Uterine evaluation is optimized using high-resolution, thin-section MR imaging with images acquired at 1.5 T or 3.0 T. Optimal signal-to-noise ratio may be achieved using a phased-array surface coil.

Recommended sequences include

- High-resolution, free-breathing T2 sequences in the axial, oblique, sagittal, and coronal planes is recommended. (High-resolution, 3-dimensional [3D], T2WI with multi-planar reformatting may also be used.) Sagittal T2WI best depicts the zonal anatomy of the uterus. T2WI acquisitions in more than one plane are helpful to avoid misinterpretation of transient uterine contractions.
- Axial T1-weighted sequence with and without fat suppression is recommended.
- Contrast-enhanced axial T1-weighted images (T1WI) of the pelvis with fat saturation is recommended.

ADENOMYOSIS

Discussion of Problem/Clinical Presentation

- Adenomyosis of the uterus is a common gynecologic condition, affecting 1% of women in the fourth and fifth decades of life and 20% to 35% of women undergoing hysterectomy for benign gynecologic disorders.[6] Most affected women are multiparous.
- The condition occurs at the endometrial-myometrial interface and is characterized by the presence of ectopic endometrial glands and stroma within the myometrium, with adjacent smooth muscle hyperplasia.
- Up to one-third of patients are asymptomatic. Symptomatic patients most frequently present with menorrhagia (50%), dysmenorrhea (30%), and metrorrhagia (20%). Occasionally, dyspareunia may be a presenting complaint.[7]
- Adenomyosis is associated with female infertility due to the overlapping pathophysiology and association with endometriosis.[8]