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Magnetic Resonance Imaging of Benign and Malignant Uterine Neoplasms

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Benign and malignant uterine masses can be seen in the women. Some of these are asymptomatic and incidentally discovered, whereas others can be symptomatic. With the soft tissue contrast resolution magnetic resonance imaging can render a definitive diagnosis, which can further help streamline patient management. In this article we show magnetic resonance imaging examples of benign and malignant masses of the uterus and their treatment strategies.
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Introduction

A myriad of tumors occur in the uterus. In this article we will discuss the benign and malignant uterine tumors, with a focus on magnetic resonance imaging (MRI) features, pathology, and treatment.

Benign

Fibroids

Uterine fibroids (leiomyomas or myomas) are the most common pelvic tumors in women, seen predominantly in African-Americans.[1-3] Fibroids appear, grow, and regress during life, especially during reproductive age, pregnancy, and postpartum period, and are seen in 35% of menstruating women.[2,3] Associated risk factors include early menarche age, nulliparity, old age at first pregnancy, obesity, diabetes, hypertension, and family history. Although generally asymptomatic, fibroids may cause abnormal bleeding, pelvic pain, pressure, and infertility, which often reduce or disappear after menopause.[2]

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Fibroids arise from uterine smooth muscle myometrium, composed of disordered smooth muscle cells and abundant extracellular matrix. Grossly, fibroids vary in size and number.[1,2] They are classified as (1) submucosal (adjacent to or in the uterine cavity), (2) intramural (entirely within the myometrium), and (3) subserosal (distort the outer contour or surface of the uterus). Moreover, subserosal and submucosal fibroids can be pedunculated (attached to the uterus by a stalk), extending from the external uterine surface or within the uterine cavity (intracavitary); pedunculated fibroids can rarely torse, leading to infarction (Fig. 1).[3-5]

The myometrium, exposed to repeated hormonal influences during reproductive years, is vulnerable to mutations. In fact, the single-gene somatic defect (MED12 mutation) is seen in most fibroids. Chromosomal rearrangements are often complex and diverse, explaining the variable growth, dormancy, and regression, and also the heterogeneous response to medical therapy. Fibroids commonly undergo degeneration, particularly if they outgrow their blood supply. Types of degeneration include hyaline, myxoid, cystic, red (carneous or hemorrhagic), and sarcomatous.[1,2]

MRI is the most accurate imaging technique for fibroid detection and localization. Nondegenerated fibroids classically appear as well-defined, rounded homogeneous masses, with decreased T2-weighted signal intensity and intermediate T1-weighted signal intensity compared with normal myometrium. Cellular fibroids (with more cellular compound and less extracellular matrix) have high T2 signal intensity and greater enhancement.[1-4] Some fibroids have a rim of T2 hyperintensity related to dilated lymphatics, veins, or edema that may

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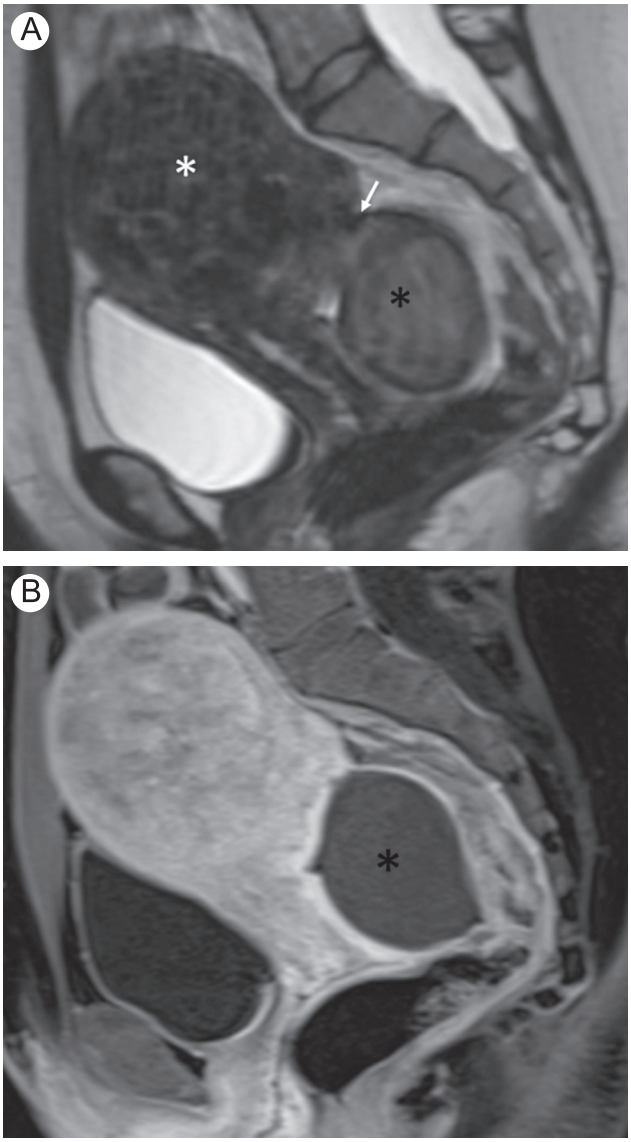

Figure 1 A 31-year-old woman presenting with acute pelvic pain secondary to an infarcted fibroid. Sagittal T2-weighted (A) MR image shows intermediate to hyperintense fibroid (black asterisk) protruding into the rectouterine space, connected posteriorly to the lower uterus by a stalk (arrow). Large hypointense fibroid superiorly (white asterisk) should be noted. (B) Contrast-enhanced MR image shows absent enhancement of the posterior pedunculated fibroid (black asterisk) compatible with infarction in the context of acute torsion, found on laparoscopy.

enhance on postcontrast images (Fig. 2).[1,2] It should be noted that this T2 signal is not considered degeneration.[2]

The presence of degeneration may alter the appearance of the fibroid in MRI.[5,6] Hyaline degeneration is the most common, occurring in more than 60% of the fibroids. On MRI, hyalinization within the fibroid is characterized by diffuse dicreased T2 signal. Cystic degeneration, found in 4% of fibroids, is seen on MRI as well-defined areas of internal fluid (high T2 signal intensity, Fig. 3). Myxoid degeneration represents cystic foci of gelatinous material, either abundant or interspersed between smooth muscle cells. On MRI, myxoid degeneration also shows low T1 signal and high T2 signal

Figure 2 A 45-year-old woman with large subserosal fibroid. Sagittal T2-weighted MR image shows the hypointense fibroid (asterisk) with T2 hyperintense rim (arrow), attributed to dilated vessels, and lymphatics and edema or both.

intensity, but in postcontrast images it may have minimal enhancement around the mucinous lakes or clefts (Fig. 4). Red degeneration is related to massive hemorrhagic infarction, resulting in coagulative necrosis, and it is most often found during pregnancy or is related to oral contraceptives. On MRI, red degeneration has variable signal intensity, with diffuse T1 hyperintensity and variable T2 signal intensity or even a peripheral halo of T1 hyperintensity and T2 hypointensity. Calcifications are found in 4% of fibroids and appear as hypointense, nonenhancing areas on all MRI sequences.[5,6]

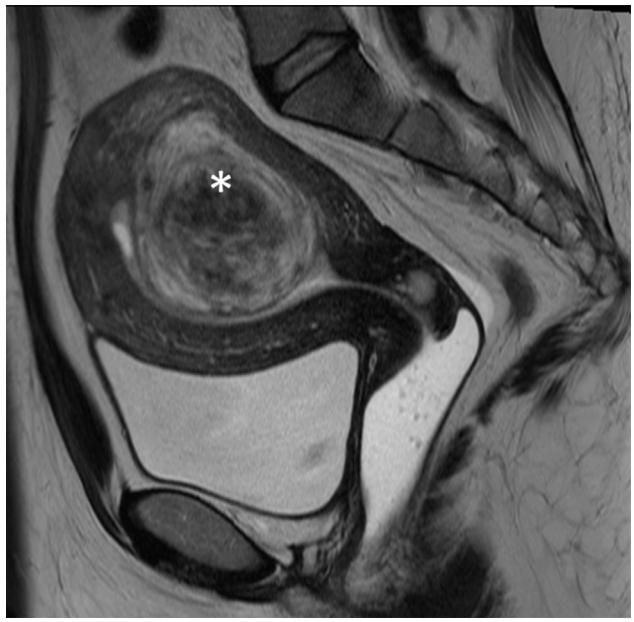

Figure 3 A 41-year-old woman with submucosal fibroid with cystic degeneration. Sagittal T2-weighted MR image shows heterogeneous predominant T2 hyperintense signal in keeping with cystic degeneration (asterisk).