# Uterine leiomyomas subtypes and their imaging mimics: how to make a differential diagnosis.

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**Authors:** C. G. Linares Villavicencio, B. Diaz-Barroso, M. Camargo Montanari, M. DEL PALACIO SALGADO, F. cabrera canal, M. A. Cruz Díaz; Alcalá de Henares. Madrid/ES  
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Learning objectives

- Discuss the clinical and imaging feature of typical presentation forms of leiomyomas.

- Describe other entities that may resemble leiomyomas in the female pelvis.
Uterine leiomyomas, also known as myomas or fibroids, are the most common gynecologic neoplasm, affecting up 20% to 50% of women in reproductive age. They are benign monoclonal tumors arising from the smooth muscle cells of the myometrium.

Typically present with menorrhagia, pelvic pain and mass effect, and in some cases, may cause reproductive or sexual dysfunction.

These tumours occur in different sites within the uterus and can be classified as submucosal, intramural or subserosal. As they enlarge they may outgrow their blood supply, resulting in subsequent degeneration that can produce different imaging appearances.

Diagnosis of leiomyomas, for the majority of patients, is made with clinical and ultrasound examination. For patients with symptoms, medical or surgical treatment may be indicated, so they will require more accurate evaluation of location, size and extent of disease. MRI is the most accurate examination for the detection and characterization of leiomyomas.

The differential diagnosis includes non-myometrial lesions such as polyps, focal adenomyosis and adenomyoma. Also includes malign tumors such us and uterine leiomyosarcoma as well as ovarian tumors such as fibroma/thecoma.

MRI can provide useful diagnostic clues in distinguishing between these entities, with improved detection rates of adenomyosis. Unfortunately is unable to predict accurately the presence of malignancy because of the imaging findings associated with degenerating leiomyomas can often overlap, so the definitive diagnosis may requires histology confirmation.
Findings and procedure details

Magnetic resonance (MR) is the most accurate imaging technique for detection and localization of leiomyomas due to its excellent capability to demonstrate the uterine zonal anatomy that enables accurate classification of individual masses as submucosal, intramural, or subserosal.

**The imaging is quite variable depending of the type of degeneration.** typically the leiomyomas demonstrate distinct low signal intensity relative to that of the myometrium on T2-weighted images, an intermediate signal intensity on T1-weighted images and demonstrate enhancement on contrast-enhanced images. These characteristic signal intensities are attributed to extensive hyalinization, which occurs in more than 60% of uterine leiomyomas. (Fig. 1 on page 7 and Fig. 2 on page 7)

**Cystic degeneration** is observed in about 4% of leiomyomas that develop cystic spaces that appear as round, well-demarcated areas that shows high signal intensity on T2-weighted images with no enhancement. (Fig. 3 on page 8 and Fig. 4 on page 9).

**Myxoid degeneration** appears as cystic masses filled with gelatinous material and will demonstrate very high T2 signal intensity and minimal enhancement.

This type of degeneration is important because it may also be seen in leiomyosarcomas and other malignant tumors. If an extensive myxoid change is seen, it may be diagnosed as myxoid leiomyoma.

**Red or carneous degeneration** may exhibit peripheral or diffuse high signal intensity on T1-weighted images and variable signal intensity with or without a low-signal-intensity rim on T2-weighted images. The entire lesion shows no enhancement, which indicates complete interruption of blood flow.

**Calcification** is usually dense and amorphous. This pattern of calcification at plain radiography almost exclusively indicates the diagnosis of leiomyoma and can be confirm in Computed Tomography (Fig. 5 on page 10). MRI shows low signal intensity on T2-weighted images, and complete absence of enhancement in T1-weighted MR with contrast. (Fig. 6 on page 11 and Fig. 7 on page 12).

**DIFFERENTIAL DIAGNOSIS**
The differential diagnosis includes non-myometrial lesions such as focal adenomyosis / adenomyoma and polyps. Benign ovarian tumors such as fibroma/thecoma as well as malign tumors such us uterine leiomyosarcoma.

It's important to adequately characterize the lesion within the uterus, to know the relationship of the lesion to the adjacent pelvic organs and structures, to identify the ovaries and uterus, and to evaluate the lesion in the patient's clinical context to avoid image pitfalls.

**ADENOMYOSIS**

- Characterized by the presence of ectopic endometrial glands and stroma within the myometrium, which are associated with reactive hypertrophy of the surrounding myometrial smooth muscle.
- **Commonly a diffuse abnormality**, at MR imaging, appears as a thickened inner myometrium called as well as junctional zone (JZ) on T2-weighted images. (Fig. 8 on page 13).
- But may also occur as a **focal mass, which is known as an adenomyoma**. The distinction from leiomyoma may be challenging; adenomyomas appears as an ill-defined, poorly margined area, usually with low signal on T2 weighted images but may contain small foci of high signal intensity on T2 weighted images (Fig. 9 on page 14), that could also presents as high signal intensity on T1-weighted images that would corresponds to hemorrhage.

**ENDOMETRIAL POLYP**

- Endometrial polyps are benign localized overgrowths of the endometrium. Most polyps are small and incidental.
- On MRI, polyps are generally well-circumscribed, **isointense on T1 signals and hypointense on T2 signals** relative to normal endometrium.
- Typically have rapid early and persistent enhancement or gradually increasing enhancement.
- Differentiating between a submucosal leiomyoma and either an endometrial polyp or carcinoma can be achieved by **demonstrating the endometrial origin on T2** weighted image of these endometrial pathologies. (Fig. 10 on page 15 and Fig. 11 on page 16)

**UTERINE LEIOMYOSARCOMA**
Leiomyosarcoma may arise in a previously existing benign leiomyoma (sarcomatous transformation) or independently from the smooth muscle cells of the myometrium.

Although it has been suggested that an irregular margin of a uterine leiomyoma at MR imaging is suggestive of sarcomatous transformation, **there are not specific imaging features established to predict accurately the presence of malignancy** in a myometrial mass, because of the imaging findings associated with degenerating leiomyomas can often overlap. (Fig. 12 on page 17 and Fig. 13 on page 18.)

The diagnosis **diagnosis of leiomyosarcoma is established histologically** by noting the presence of infiltrative margins, nuclear atypia, and increased mitotic figures.

**SOLID ADNEXAL MASS**

- **Fibroma and thecoma** are forms of a spectrum of benign tumors. Lipid-rich thecoma can show estrogenic activity. Fibroma is the most common sex cord tumor.
- They have a large fibrous component and similar signal intensity to that of a pedunculated leiomyoma.
- MR imaging allows detection and characterization of normal ovaries, as well as it can demonstrate adnexal masses, **usually surrounded by ovarian stroma and follicles establishing the ovarian origin.** (Fig. 14 on page 19 and Fig. 15 on page 20).
- CT scan shows homogeneous solid tumor with delayed slight enhancement (Fig. 16 on page 21). MRI shows **low signal intensity on T1 and T2 weighted image** (Fig. 17 on page 22). Observation of the interface vessels between the uterus and adnexal masses seems to be useful in differentiating leiomyoma from ovarian fibroma.
Fig. 1: Typical leiomyoma in a 37-year-old woman (a) Sagittal spin-echo T2-weighted MR image shows a well-demarcated mass of distinct low signal intensity with a speckled appearance, with intense enhanced at (b) T1 - weighted MR with contrast. Histopathologic showed hyaline degeneration throughout the lesion.

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Fig. 2: Typical leiomyoma in a 37-year-old woman (a) Sagittal spin-echo T2-weighted MR image shows a well-demarcated mass of distinct low signal intensity with a speckled appearance, with intense enhanced at (b) T1 - weighted MR with contrast. Histopathologic showed hyaline degeneration throughout the lesion.

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**Fig. 3:** Axial spin-echo T2-weighted MR image shows leiomyoma of low to intermediate signal intensity with an small foci of very high signal intensity on the T2-weighted image (a) and no enhancement on the contrast-enhanced image (b) that represents cystic degeneration.

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Fig. 4: Axial spin-echo T2-weighted MR image shows leiomyoma of low to intermediate signal intensity with small foci of very high signal intensity on the T2-weighted image (a) and no enhancement on the contrast-enhanced image (b) that represents cystic degeneration.

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**Fig. 5:** Axial CT shows dense and amorphous pattern of calcification in leiomyoma.

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Fig. 6: Leiomyoma with calcification in a 42 year old woman. Sagittal fast spin-echo T2-weighted (Fig. 5) and T1-weighted MR with contrast (Fig. 6) show a mass with areas with distinct low signal and complete absence of enhancement.

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Fig. 7: Leiomyoma with calcification in a 42 year old woman. Sagittal fast spin-echo T2-weighted (Fig. 5) and T1-weighted MR with contrast (Fig. 6) show a mass with areas with distinct low signal and complete absence of enhancement.

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Fig. 8: Sagittal spin-echo T2-weighted MR image. Diffuse adenomyosis in a 45 year old woman, with thickening of the JZ (arrow) greater than 12 mm.

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Fig. 9: Sagittal spin-echo T2-weighted MR image. A 34-year-old woman with adenomyoma demonstrated on biopsy, shows focal thickening of the JZ (arrow) of the myometrium, with barely visible small cystic spaces
**Fig. 10:** A 32 year old woman with endometrial polyp. Sagittal T2-weighted image (Fig. 10) shows the polyp (arrowhead) with stalk arising from the endometrium with avidly enhancing at T1-weighted MR with contrast (Fig. 11).

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Fig. 11: A 32 year old woman with endometrial polyp. Sagittal T2-weighted image (Fig.10) shows the polyp (arrowhead) with stalk arising from the endometrium with avidly enhancing at T1- weighted MR with contrast (Fig. 11).

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**Fig. 12:** 44 year old woman with leiomyosarcoma mischaracterized as a leiomyoma. (Fig. 10) Sagittal T2-weighted show low-signal-intensity mass and (Fig. 11) Sagittal T1-weighted, fat-suppressed, postcontrast shows enhancing uterine mass.

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**Fig. 14:** Right ovarian fibrothecoma (arrow) suspicion of adnexal mass/subserosal myoma at US examination. Fig. 12: T2-weighted MR image confirms the ovarian dependence (arrowhead). Fig 13: Axial T1-weighted, fat-suppressed, postcontrast: Shows low caption of the ovarian tumor (arrow) than an adjacent subserosal leiomyoma with hyaline degeneration (star).

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Fig. 16: Ovarian Fibroma in 29 year old woman: Typical homogeneous mild enhancing solid mass (star) is seen in enhanced axial CT (Fig.14). On Axial T2 weighted image, the mass shows low signal. (Fig.15)

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Conclusion

Leiomyomas are the most common benign gynecologic neoplasm. They can have vary widely MR imaging appearances that may present a diagnostic problem. It is important to be familiar with the image featuring to distinguish them from other pathologies, since it affects the therapeutic management of the patient.
References


