Role of pelvic MRI in detection and characterization of uterine leiomyoma

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Learning objectives

1. Remind the new FIGO classification of uterine leiomyomas.

2. Describe different radiological appearances of myomas according to their histological subtypes or form of degeneration.

3. Understand MR imaging features that allows ruling out differential diagnosis.

Background

Leiomyoma is the most frequent pelvic benign neoplasm affecting approximately 30% of women in reproductive age. Most fibroids are asymptomatic, but patient may present with abnormal uterine bleeding or bulk-related symptoms requiring a surgical treatment.

Ultrasonography is still the first diagnostic test for patients with fibroids, but can provide insufficient results. Magnetic resonance Imaging (MRI) is the most accurate imaging modality for detection, mapping and characterization of leiomyomas and their mimics. It helps referring patients to the most appropriate therapy and has become the most adequate modality before surgery or uterine fibroid embolization.

Findings and procedure details

Pelvic MRI is the most effective imaging method for detection, localization and characterization of leiomyomas.

1. Localization of leiomyomas:

* Single or multiple fibroids and their size: number and size of leiomyomas must be indicated to attempt conservative treatment

* Part of the uterus involved by the myoma: uterine corpus, fundus or the cervix

* Anterior, posterior or lateral localization of myoma
*Depth localization in myometrium according to the new FIGO classification

*Relationship with neighboring structures

- FIGO classification of myomas (2011): Fig.1

Traditionally, myomas were classified as follows:

*Submucosal: they are located beneath the mucosal lining and are immediately adjacent to or protrude into the uterine cavity; they indent or distort the endometrium.

*Intramural: The most common location for leiomyomas, they are entirely within the uterine wall.

*Subserosal: They are located beneath the serosa and distort the outer surface of the uterus.

*Pedunculated leiomyomas: Attached to the uterus by a stalk, they may be intracavitary or subserosal.

Since 2011, the new FIGO classification subdivides myomas in 9 types according to their location in myometrium. This classification has a clinical significance because symptoms and treatment vary among these subtypes of leiomyomas.

*Subtype 0: Pedunculated intracavitary Fig.2

*Subtype 1: Submucosal <50% intramural Fig.3

*Subtype 2: Submucosal >50% intramural

*Subtype 3: Intramural, comes in contact with endometrium

*Subtype 4: Intramural Fig.4

*Subtype 5: Subserosal >50% intramural Fig.5

*Subtype 6: Subserosal <50% intramural

*Subtype 7: Subserosal pedunculated Fig.6

*Subtype 8: Other (e.g cervical)

*Hybrid 2-5 : Subserosal AND submucosal
2. Characterization of leiomyomas:

Leiomyoma is composed of smooth muscle and fibrous connective tissue. It usually appears as a well-defined, homogenous mass, hypointense to myometrium in T2-weighted images. Fig.7

As leiomyomas enlarge, they may undergo various forms of degeneration: hyaline, myxoid degeneration, calcification, oedematous, cystic, hemorrhagic, or fatty degeneration.

- **Hyaline degeneration**: Fig.8
  This is the most common type of secondary degeneration. The hyalinized areas microscopically consist of eosinophilic bands infiltrating the muscle bundles with paucicellularity. Hyaline degenerated fibroids appear in MRI as heterogeneous masses, deeply hypointense in T2 weighted images with low enhancement after injection of gadolinium.

- **Myxoid degeneration**:
  It is characterized by a mucoid content. Fibroids have an extremely high T2-weighted signal, high T1-weighted signal and enhance minimally after injection of Gadolinium.

- **Cystic degeneration**: Fig.9
  Rare type of degeneration. The cystic area appears as a well-defined portion of liquid signal: hypointense in T1-weighted images, hyperintense in T2-weighted images, with no enhancement.

- **Oedematous degeneration**: Fig.10
  This is a common type of degeneration, usually peripheral, characterized by a high signal in T2-weighted images and intense enhancement.

- **Hemorrhagic degeneration**: Fig.11
  It is an uncommon type of degeneration due to thrombosis of peripheral vessels, often associated with pregnancy or with the use of contraceptive drugs. Such leiomyomas have high signal intensity in T1-weighted images, the T2-weighted images signal is variable.
• **Fatty degeneration:**

Is an extremely rare type of degeneration recognized by a T1 and T2 hypersignal that disappears on the fat saturation sequences.

• **Necrosis:** [Fig.12]

Necrosis is usually due to thrombosis of arterial and venous vessels. It also may result from torsion of a pedunculated myoma and usually occurs during pregnancy or use of contraceptive drugs. Unlike other types of degeneration, it produces clinical symptoms of abdominal pain and tenderness. Such necrosis is characterized by a ring shape hyperintensity in T1 weighted images and no inner enhancement after Gadolinium administration.

3. **Differential diagnosis:**

• **Adenomyosis:** [Fig.13]

Adenomyosis is defined by migration of endometrial glands into myometrium. Adenomyosis may occur either in a focal or diffuse form. Differential diagnosis between leiomyoma and a focal form of adenomyosis, also called anedomyoma, is difficult; it is based on the unclear thickening of the junctional zone superior to 12mm in adenomyosis whereas leiomyoma appears as a well circumscribed mass and visualization of millimetric spots hyperintense in T2 weighted sequences, suggestive of adénomyomas. The clinical manifestations of fibromas and adenomyosis are similar, while treatments are different, emphasizing the importance of distinction between both entities at MRI.

• **Leiomyosarcoma:**

Uterine leiomyosarcoma is a rare malignant tumor, arising either from uterine musculature or from a preexisting fibroid. Macroscopically, leiomyosarcoma often presents as a bulky isolated mass with irregular outlines and heterogeneous, necrotic and hemorrhagic reorganizations. Imaging diagnosis by MRI may be difficult. Leiomyosarcomas usually present an intermediate signal intensity on T2-weighted sequences with areas of hypersignal due to hemorrhagic necrosis. It generally has a low to intermediate signal intensity on T1-weighted sequences, but hyperintensity may be noticed in hemorrhagic areas. Best clues to recognize leiomyosarcoma, as opposed to a degenerated leiomyoma, are poorly defined borders, intense enhancement during arterial phase, hyperintensity on DWI sequences with low ADC <0.8 mm² per second.
• **Solid adnexal mass:**

Ovarian fibrothecoma belongs to the group of ovarian stromal tumors. It usually presents as unilateral, well defined mass deeply hypointense in T1 and T2 weighted sequences. MRI is the best imaging tool to distinguish pedunculated subserosal leiomyoma from solid adnexal mass; diagnosis clues are visualization of the stalk and normal ovaries.

**Images for this section:**

**Fig. 1:** New FIGO classification of leiomyomas

© Munro. FIGO classification system for causes of AUB. Fertil Steril 2011
Fig. 2: T2 weighted sagittal and axial images showing a pedunculated intracavitary myoma

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Fig. 3: T2 weighted sagittal and axial images showing a type1 leiomyoma

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**Fig. 4:** Sagittal T2 weighted image: intramural leiomyoma (type 4) in white arrows. Note the associated subserosal leiomyomas (type 5 and 6) in red arrows.

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Fig. 5: fibroid in sagittal T2 weighted sequence, distorting the outer surface of uterus

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Fig. 6: Subserosal pedunculated leiomyoma on T2 weighted sequence (white arrow)

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**Fig. 7:** Non-degenerated leiomyoma (white arrow): Well-circumscribed homogenus mass, hypointense to myometrium on T2 (a) and T1 (b)-weighted sequences, mildly enhanced after gadolinium injection (c).

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**Fig. 8:** Intracavitary (type 0) hyaline degenerated leiomyoma: Deep hyposignal in T2-weighted images (a), isosignal to myometrium in T1 weighted images (b), with low enhancement after Gadolinium administration.

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**Fig. 9:** Intramural (type 5) leiomyoma with cystic degeneration (white arrow)

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**Fig. 10:** Large leiomyoma in oedematous degeneration, presenting an intermediate heterogeneous hypersignal in T2-weighted sequences (a) with intense enhancement (b)

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**Fig. 11:** Large multiple fibroids with hemorrhagic areas in hypersignal in T1 FatSat sequence (b), non-enhanced after Gadolinium injection (c)

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**Fig. 12:** Leiomyoma presents a ring shape hypersignal in T1 weighted images (white arrow), non-enhanced after Gadolinium injection, due to necrosis.

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Fig. 13: Sagittal T2-weighted sequence: thickening of the junctional zone with multiple hyperintense spots (white arrow) and loss of differentiation-junctional area myometrium

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Conclusion

MRI is the most accurate imaging modality for detection, mapping and characterization of leiomyomas and provides the key points for adequate management of uterine fibroids

Personal information

References


