Review of MRI findings in uterine adenomyosis: a picture essay

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Learning objectives

• Review the current histopathological classification of adenomyosis.
• Review the main MRI findings of adenomyosis.
• Calling attention to the importance of the findings of adenomyosis on transvaginal ultrasound examinations.

Background

• Adenomyosis is a common gynecologic condition, nonneoplastic, that causes substantial morbidity and that affects women of reproductive age.
• The clinical symptoms of adenomyosis include: pelvic pain, uterine enlargement, dysmenorrhea, menorrhagia, or may be asymptomatic.
• Diseases with symptoms similar to adenomyosis: dysfunctional uterine bleeding, endometriosis and leiomyomas.
• Adenomyosis is rarely diagnosed before hysterectomy and commonly coexists with uterine leiomyomas.
• Women undergoing hysterectomy with both adenomyosis and leiomyomas have a number of different clinical features compared with women with only leiomyomas at the time of hysterectomy.
• Women with substantial pain despite a smaller fibroid burden may be more likely to have concomitant adenomyosis.

Histopathology:

• Uterine adenomyosis is characterized by benign invasion of ectopic endometrium into the myometrium with hyperplasia of adjacent smooth muscle.
• The histopathologic features is varied and contribute to its imaging appearance.
• The occurrence of vascular involvement in adenomyosis has been noted earlier, but there has been little detailed study of this phenomenon.
• Pathologists should be aware of the phenomenon of vascular involvement in adenomyosis, which is relatively common and, when widespread, may result in the consideration of a neoplastic process.
• The pattern of vascular involvement raises the possibility that adenomyosis develops from cells intimately associated with myometrial blood vessels, perhaps multipotential perivascular cells.
• Histological classification of endometriosis on the deep involvement of the endometrium: superficial (up to 2 to 3 mm of endometrial basal layer); Moderate (around 1-2 cm); Deep (when it extends to serosa).
• The degree of myometrial penetration is relevant because there is a correlation with symptoms and assumes importance in surgical planning, with conservative treatment in the superficial lesion (endometrial ablation) and surgical treatment or embolization in deep adenomyosis.

Current histopathological classification of adenomyosis:

• Myometrial invasion of at least one island of endometrial tissue (stroma and gland) by the average field or 1.8 mm from the basal layer.
• Muscle hypertrophy and reactive fibrosis
• Disorganization of the middle muscular layer lHemorrhage and cystic dilatation of endometrial glands that may develop into functioning endometrial cysts.
• Foci of hemosiderin.
• Fatty degeneration.

Methods of Diagnostic Imaging:

• Ultrasound and magnetic resonance imaging (MRI) may allow accurate non-invasive diagnosis.
• The diagnosis of adenomyosis was made if one or more of the following sonographic findings were present:
  # a globular uterine configuration;
  # poor definition of the endometrial-myometrial interface;
  # sub-endometrial echogenic linear striations;
  # myometrial anterior-posterior asymmetry;
  # myometrial cysts; and
  # a heterogeneous myometrial echotexture.

• The presence of subendometrial echogenic linear striations, a heterogeneous myometrial echotexture, and myometrial anterior-posterior asymmetry on transvaginal ultrasonography supports the diagnosis of adenomyosis.
• Among the transvaginal ultrasonographic findings consistent with the diagnosis of adenomyosis, subendometrial linear striations had the highest diagnostic accuracy.
• The clinical diagnosis is difficult and MRI is a highly accurate noninvasive modality for diagnosing adenomyosis, but it's necessary a high degree of suspicion in transvaginal ultrasound examinations performed routinely.
• Magnetic resonance imaging (MRI) has been considered the best method in the evaluation of adenomyosis, because it has high capacity for tissue differentiation and allows the monitoring of evolution.

**Imaging findings OR Procedure details**

**IMAGING FINDINGS:**

• We reviewed 80 cases of adenomyosis diagnosed by MRI, performed on 1.5 T scanner with specific protocol (FIG 1).
• All examinations were analyzed by two radiologists independently, and discordant findings were reviewed by consensus.
• We reviewed retrospectively the ultrasonographic examinations, and histopathological findings in these patients.
• Magnetic resonance imaging (MRI) is considered the best method in the evaluation of adenomyosis.
• Typical adenomyosis appears as an ill-demarcated low-signal-intensity area on T2-weighted images owing to abundant smooth muscle proliferation (FIG 2).
• On T2-weighted MR images, ectopic endometrium appears as small high-signal-intensity areas like normal endometrium.
• Susceptibility-weighted imaging is sensitive for old hemorrhagic foci, which appear as spotty signal voids owing to the T2*-shortening effects of hemosiderin.
• The diagnosis of adenomyosis is performed in MRI with excellent reliability when the thickness of the junctional zone is greater than or equal to 12mm, this is thickening, focal or diffuse, which is represented histopathologically by smooth muscle hyperplasia and reactive fibrosis of the tissue to ectopic implantations endometrial (FIG 3,4,5).
• The hypointense signal of adenomyosis on T2-weighted images characterized by thickening of the junctional zone is caused by hypertrophy of smooth muscle dense reaction involving glands and endometrial stroma (FIG 6).
• On T2-weighted images, linear striations can be seen leaving the endometrium extend through the myometrium, representing the process of ectopic implantation of endometrial glands, with direct inversion of the basal layer of the endometrium in the myometrium, which is highly indicative of adenomyosis (FIG 7,8).
• The presence of glands with cystic dilatation or foci of heterotopic endometrial tissue bleeding is identified in approximately 50% of patients. Interspersed among the thickened junctional zone, can be detected foci isointense on T1 and hyperintense on T2, which correspond to non-hemorrhagic endometrial tissue, characterizing the stromal form. These outbreaks can be rounded, linear or fingerlike. At histopathology are
observed islets of heterotopic endometrial tissue with endometrial glands with a rounded or linear and cystic dilatation of endometrial glands (FIG 8,9,10).

• The other form of adenomyosis is focal, also called adenomyoma of Cullen, a macronodular fibroglandular of ill-defined limits, which stretches along the junctional zone of the myometrium, without determining significant mass effect on the endometrial cavity

• On T2-weighted images identified lesion is elliptical, hypointense, and edge slightly irregular and ill defined, homogeneous or slightly heterogeneous, interspersed with hyperintense foci suggestive of the presence of endometrial glands ectatic or endometrial cysts, which, when present, increase diagnostic specificity (FIG. 11).

• When the adenomyoma is a small nodules may present an appearance similar to leiomyoma with sharply defined borders, making it difficult to differentiate.

• Adenomyosis cavity which is an atypical presentation may be confused with other diseases that progress to cavitary degeneration, such as leiomyoma with central necrosis and leiomiossacoma. In this case, the myometrium presents: hypertensive foci on T1 and T2 images suggestive of endometrial glands with hematic content, and images of venous lakes (FIG.12).

MRI diagnostic criteria

• Thickening of the junctional zone between 8 and 11mm:
  # Symptomatic patient;
  # Localized thickening;
  # Irregular contour;
  # Heterogeneous signal intensity.

• Differential Diagnosis:
  • Leiomyoma;
  • Uterine contraction;
  • Muscle hypertrophy;
  • Endometrial carcinoma.
The differentiation between leiomyoma and adenomyosis is important because both are similar clinically and in some imaging studies, in addition, the treatment options for each, can be distinguished (FIG.13,14).

Images for this section:

Fig. 1: Age groups of 80 patients with adenomyosis: there was a prevalence in the fourth and fifth decades, as reported in the literature.
**Fig. 2:** Female. 32 years old. MR sagittal T2. Adenomyosis: junctional zone thickening. Incidentally there is an adnexal cyst.
**Fig. 3:** Female. 35 years old. MR sagittal T2. Posterior myometrial wall thickening (2.5 cm) showing area of low signal on T2 and T1 isossinal with irregular contours and a few small cysts.
**Fig. 4:** Women 26 years. Bicornuate uterus with adenomyosis with focal nodular. T2-weighted MRI in coronal and axial.

**Fig. 5:** Same patient. T2 sag/axial showing thickening of the junctional zone.
**Fig. 6:** 49 yo. Diffuse adenomyosis. Patient with dermoid cyst (mature teratoma) in the right ovary.

**Fig. 7:** 26 yo: T2 SAG. Thickening of the junctional zone posterior body extending to serosa. Deep endometriosis.
**Fig. 8:** Same patient in Fig anterior. Endometriose deep. T2 coronal. T2FS axial.

**Fig. 9:** Patient 35 yo. MRI T2-weighted coronal plane showing hyperintense foci in junctional zone consistent with glandular ectasia. Histopathology was dilated endometrial gland.
**Fig. 10:** Small focus of hyperintensity on T1FS and T2 (arrow) in body wall anterior, compatible with dilated endometrial gland.

**Fig. 11:** 45 yo. Multiple foci of hyperintensity on T2. Observe the correlation with histopathology, which identify multiple dilated glands around the myometrium.
Fig. 12: A dilated gland in the histopathological exam, giving the appearance of "cavity" in MRI exams.
Fig. 13: 48 yo. Retroverted uterus with adenomyosis and small Leiomyoma in the anterior wall (arrow).

<table>
<thead>
<tr>
<th>Adenomyoma</th>
<th>Leiomyoma:</th>
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</thead>
<tbody>
<tr>
<td>Nodule with poorly defined edges</td>
<td>Well-defined nodule</td>
</tr>
<tr>
<td>Little mass effect</td>
<td>Oval or rounded</td>
</tr>
<tr>
<td>Elliptical shape</td>
<td>Mass effect proportional to the volume</td>
</tr>
<tr>
<td>Absence of peripheral vessels</td>
<td>Peripheral vessels</td>
</tr>
<tr>
<td><strong>Hyperintense foci on T1 and T2</strong></td>
<td>Nodule hypointense on T1-weighted sequences</td>
</tr>
</tbody>
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Fig. 14: Differential Diagnosis Adenomyoma X Leiomyoma in MRI.
Conclusion

• MRI to be highly accurate of adenomyosis, with several studies demonstrate a sensitivity and specificity of 86%-100%.
• Adenomyosis actually differs markedly in pathologic features and it's important to be familiar with a wide variety of MRI findings of adenomyosis.
• Endovaginal US is used as a initial imaging modality in patients with gynecologic symptoms, and it is important that the sonographers and radiologists to familiarize themselves with the appearance of the adenomyosis and so they can include it in the differential diagnosis of these patients.

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Study site

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Potential Conflict of Interest

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References


