Deep endometriosis of the posterior pelvic compartment: a MRI pictorial guide.

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Learning objectives

- To emphasize the role of MRI in the detection of foci of deep endometriosis of the posterior pelvic compartment.

- To show the correct acquisition protocol, the main features and the typical localizations of deep endometriosis of the posterior pelvic compartment.
Background

Endometriosis is a chronic inflammatory disease affecting mainly women during the reproductive age and it is characterized by the presence of endometrial tissue outside the endometrium [1].

Endometriosis is a multi-factorial disorders with an unclear etiology and pathogenesis. Three are the main theories proposed.

The **metastatic theory**, which is the most widely accepted, assumes that endometrial cells are transported by retrograde menstrual flux on the surface of the peritoneal cavity. Vascular-lymphatic pathways and intraoperative implants were also proposed as routes of metastatic spread [1-2].

The **metaplastic theory** suggests the differentiation of peritoneal cells into functioning endometrial cells due to the common embryological origin of peritoneal and endometrial cells from the coelomic epithelium. Differentiation from müllerian remnant tissue was also suggested [1-2].

The **induction theory** assumes that substances released by shed endometrium induce the transformation of undifferentiated parenchyma into endometrial tissue [1-2].

A correct diagnosis and localization of the disease as accurate as possible is mandatory for the preoperative planning. Laparoscopy is the gold standard technique for the diagnosis and treatment.

MRI represents the best non-invasive imaging method for the diagnosis of endometriosis due to its intrinsic high spatial resolution and tissue characterization, allowing a complete survey of the pelvis without the use of ionizing radiations [3].
Findings and procedure details

When endometriosis invades the subperitoneal space for more than 5 mm in depth, it's called deep endometriosis [4].

Accuracy, sensitivity and specificity of MRI in the evaluation of deep endometriosis were > 90% in different studies [5-6].

It is frequently associated with dysmenorrhea, dyspareunia, pelvic pain, backaches, urinary tract symptoms and infertility [4].

Posterior compartment of the pelvis is the most common localization of deep endometriosis [3-4]. Fig.1-4 show the main anatomical sites of disease.

A correct execution of the MRI examination is based on the acquisition of T2w and T1w images on axial, sagittal and coronal planes.

Our acquisition protocol consists of:

- axial, sagittal and coronal T2w TSE images
- axial T2w SPAIR images
- axial T1w TSE images
- axial and sagittal T1w SPAIR images after intravenous contrast medium injection (if necessary).

Slice thickness: 4-5 mm.

Fluid distension of vaginal and rectal cavities is recommended because collapsed hollow organs prevent the correct depiction of small foci of disease involving visceral walls, and seems to improve sensitivity and specificity of the technique [7-8].

Contrast medium injection helps in the differentiation between deep endometriosis and scars, allowing the demonstration of the activity of the disease, improving specificity [9].
Post-contrast acquisitions are also useful when endometriosis is suspected during examination performed for other reasons or when patients refused fluid distension of the cavities, improving sensibility.

At histological examination, fibromuscular hyperplasia surrounding ectopic endometrial glands are typical findings of deep endometriosis. This explains the MRI appearance of endometriosis as hypointense lesions on T2w acquisitions with hyperintense spots inside (Fig.5), sometimes with hyperintense foci on T1w images due to haemorrhagic phenomena (Fig.6) [2-3,8-9].

Endometriotic lesions are usually detected as plaques (Fig.7), nodules (Fig.8) or focal or diffuse thickening (Fig.9); star-like appearance lesions with spicules and adhesions to surrounding structures can be seen due to fibrotic reaction characterizing the disease (Fig.10 and Fig.11) [2-3,8-9].

The "mushroom cap" sign (Fig.12), described on sagittal or axial planes as a T2 heterogeneous hypointense mushroom cap shaped lesion, due to hypertrophic muscularis propria, growing into the bowel lumen, surrounded by hyperintense mucosal and submucosal layers, is a typical sign of deep rectosigmoid colon endometriosis [10].

Posterior deep endometriosis usually involves retroperitoneal and dependent posterior intraperitoneal regions often resulting in adhesions between adjacent peritoneal surfaces of the anterior rectal wall and posterior vaginal fornix with consequent invasion of the muscular layers of both organs [9].

Based on the location on transrectal ultrasonography and MRI imaging retroperitoneal lesions were classified in:

- rectovaginal septum lesions (Fig.7), extending from posterior wall of the vaginal mucosa to the anterior wall of the rectal muscularis, under the peritoneal fold of the Douglas pouch (type 1);

- posterior forniceal lesions (Fig.8), small lesions involving the posterior fornix and the retrocervical area-torus uterinus, without deep infiltration of the rectovaginal septum or rectal wall (type 2);

- hourglass-shaped lesions (Fig.13), expanding from posterior fornix and retrocervical area-torus uterinus toward the anterior rectal wall infiltrating its muscularis (type 3) [9,11].

Retrocervical endometriosis usually involves the uterosacral ligaments that appear thickened or with internal small nodules (Fig.9).

Retroversion of the uterus and angular rectal attraction (Fig.14) are often seen due to the fibrotic behavior of the disease [3].
Recto-sigmoid walls endometriosis (Fig.15-18) usually involves the serosal layer but can also extend into the muscularis propria, causing bowel strictures and cyclic haemorrhage [3].

The involvement of the other surrounding pelvic structures as ovaries or fallopian tubes (Fig.19-20) can be seen.
Fig. 1: T2w sagittal image. Anatomy of the pelvic posterior compartment related to most frequent localizations of endometriosis: recto-vaginal septum (red line), recto-uterine pouch (outlined in yellow), posterior fornix of the vagina (blue asterisk).

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Fig. 2: T2w sagittal image. Anatomy of the pelvic posterior compartment related to most frequent localizations of endometriosis: retrocervical area (outlined in red).

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Fig. 3: T2w axial image. Anatomy of the pelvic posterior compartment related to most frequent localizations of endometriosis: posterior fornix of the vagina (blue asterisk).

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Fig. 4: T2w axial image. Anatomy of the pelvic posterior compartment related to most frequent localizations of endometriosis: torus uterinus (red arrow), uterosacral ligaments (yellow arrows).

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Fig. 5: T2w axial image. Nodule of endometriosis involving the posterior wall of the vagina (red arrow). Note the small hyperintense foci into the lesion due to the glandular component.

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Fig. 6: T1w axial image. Nodular thickening of the posterior wall of the vagina, suggestive of endometriosis (red arrow). Note the small intrallesional hyperintense spots due to haemorrhagic phenomena.

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Fig. 7: T2w sagittal image. Recto-vaginal septum endometriotic plaque, with small hyperintense spots inside, infiltrating the anterior rectal wall (yellow arrow).

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Fig. 8: T2w sagittal image. Nodule of endometriosis involving the posterior vaginal fornix. Note the hyperintense spots due to the glandular component (blue arrow).

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**Fig. 9:** T2w axial image. Endometriotic thickening of torus uterinus (blue arrow) and right uterosacral ligament (yellow arrow). Note that the implant of endometriosis extends to reach the anterior rectal wall.

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**Fig. 10:** T2w sagittal image shows a star-like appearance endometriotic lesion (red arrow).

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Fig. 11: T2w coronal image. Star-like appearance of endometriotic lesion (red arrow). The patient is the same of Fig.10.

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Fig. 12: T2w sagittal image. "Mushroom cap" sign: a mushroom cap like endometriotic lesion growing into the anterior rectal wall (blue arrow).

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Fig. 13: T2w sagittal image shows an hourglass-shaped lesion extending from retrocervical area to the anterior wall of the sigmoid-rectum (red arrow).

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Fig. 14: T2w sagittal image. Obliteration of the recto-uterine pouch due to a plaque of endometriosis (red arrow). Note as the uterus is posteriorly retracted and it adheres to the anterior wall of the rectum that appears angulated.

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Fig. 15: T2w axial image shows sigmoid endometriosis (blue arrow). Note the thickened wall and the hyperintense spots due to glandular components.

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**Fig. 16:** T1w axial image shows sigmoid endometriosis (blue arrows). Note the irregular margins of the walls and the hyperintense foci related to haemorrhagic phenomena. The patient is the same of Fig.15.

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Fig. 17: T2w sagittal image shows a plaque of endometriosis (red arrow) extending from the retrocervical area to the sigmoid walls.

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Fig. 18: T1w post-contrast sagittal image shows a plaque of endometriosis extending from the retrocervical area to the sigmoid walls. The patient is the same of Fig.17. Note the better depiction of the extension of sigmoid wall involvement after contrast medium injection (yellow arrow).

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Fig. 19: T2 sagittal image shows retrocervical endometriosis involving the anterior sigmoid wall (red arrow). Note the hydrosalpinx (blue star) due to the involvement of the left fallopian tube.

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Fig. 20: T2w coronal image shows left hydrosalpinx (blue star) due to the presence of an endometriotic plaque that involves the left fallopian tube. The patient is the same of Fig.19.

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Conclusion

Although laparoscopy is the best method in the diagnosis of endometriosis, MRI represents the most specific and sensitive non-invasive technique in the assessment of deep infiltrating endometriosis of the posterior pelvic compartment, allowing a proper management of patients.

The knowledge of the typical features and sites of disease together with a correct execution of the MRI examination, are fundamental to recognize endometriosis.
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References


