

Magnetic resonance imaging in deep pelvic endometriosis: iconographic essay*

Ressonância magnética na endometriose pélvica: ensaio iconográfico

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Abstract Endometriosis is characterized by the presence of normal endometrial tissue outside the uterine cavity. In patients with deep pelvic endometriosis, uterosacral ligaments, rectum, rectovaginal septum, vagina or bladder may be involved. Clinical manifestations may be variable, including pelvic pain, dysmenorrhea, dyspareunia, urinary symptoms and infertility. Complete surgical excision is the gold standard for treating this disease, and hence the importance of the preoperative work-up that usually is limited to an evaluation of sonographic and clinical data. Magnetic resonance imaging is of paramount importance in the diagnosis of endometriosis, considering its high accuracy in the identification of lesions intermingled with adhesions, and in the determination of peritoneal lesions extent. The present pictorial review describes the main magnetic resonance imaging findings in deep pelvic endometriosis.

Keywords: Magnetic resonance imaging; Endometriosis; Female pelvis; Infertility.

Resumo A endometriose caracteriza-se pela presença de tecido endometrial funcionando heterotópico. Em pacientes com endometriose pélvica profunda pode haver acometimento dos ligamentos útero-sacros, reto, septo retovaginal, vagina ou bexiga. Os sintomas podem ser variados e incluem dor pélvica, dismenorréia, dispáreunia, sintomas urinários e infertilidade. O padrão-ouro para o tratamento é a ressecção completa dessas lesões. Assim, é muito importante a avaliação pré-operatória dessas pacientes, sendo esta avaliação, em geral, limitada em relação aos dados clínicos e ultra-sonográficos. A ressonância magnética tem grande importância no diagnóstico da endometriose, principalmente por permitir a identificação das lesões de permeio a aderências e a avaliação da extensão das lesões subperitoneais. Neste estudo são ilustrados, na forma de ensaio iconográfico, os principais achados da endometriose pélvica profunda à ressonância magnética.

Unitermos: Imagem por ressonância magnética; Endometriose; Pelve feminina; Infertilidade.

Coutinho Junior AC, Lima CMAO, Coutinho EPD, Ribeiro EB, Aidar MN, Gasparetto EL. Magnetic resonance imaging in deep pelvic endometriosis: iconographic essay. *Radiol Bras.* 2008;41(2):129–134.

INTRODUCTION

Firstly described in 1860 by Von Rokitsansky⁽¹⁾, endometriosis is defined as the presence of functional endometrial tissue outside the endometrial cavity and myometrium^(2,3). Endometriosis is a frequent

disease attributed to multifactorial causes, affecting 7% to 10% of women in the general population^(3,4). The most widely accepted theory is that viable endometrial cells originating from a physiological phenomenon called retrograde menstruation, result in implantation into the peritoneal cavity (Sampson's theory)^(2,5-7). Studies in the literature report a wide range of factors of individual risk such as low parity, age, ethnic origin, height, body mass index, alcohol abuse, tobacco smoking, among others⁽⁸⁾.

The significant role of MRI in the diagnosis of endometriosis is related to the identification of intermingled lesions in the presence of adhesions, and also the demonstration and evaluation of sub-peritoneal lesions extent in cases where these lesion cannot be visualized by laparoscopy, with accuracy, sensitivity and specificity > 90% for deep endometriosis^(9,10). MRI findings

are more specific than those of ultrasonography and computed tomography^(8,9,11-13).

Generally, endometriosis implants are confined to the pelvis, the most common sites, in order of decreasing frequency, being ovaries, broad ligaments, anterior and posterior cul-de-sac, and utero-sacral ligaments; however, distant sites may be involved^(2,4,7,9). Endometrial tissue implants are affected by cyclic menstrual changes with periodic bleedings. Hemorrhage inside these implants induces an acute pelvic inflammatory reaction and consequential adhesions development, frequently with Douglas cul-de-sac obliteration, Fallopian tubes and ovaries distortion.

In patients with deep pelvic endometriosis, by definition, there is a sub-peritoneal ≥ 5 mm penetration by endometrial implant. Deep endometriosis generally is found in the retrovaginal septum, rectum, bladder and other pelvic fibromuscular

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Received August 9, 2007. Accepted after revision September 11, 2007.

structures such as uterine ligaments and vagina^(4,7,8). Despite the asymptomatic nature of the disease in many women affected by peritoneal endometriosis, patients with deep pelvic endometriosis may present with pelvic pain, dysmenorrhea, dyspareunia, urinary symptoms and infertility^(2,5,6). MRI presents the advantage of fast acquisition of multiplanar sequences, providing simultaneous images of all the pelvic viscera both at rest and under stress^(11,12). Despite some limitations, MRI plays a significant role in the diagnosis of endometriosis, especially for allowing the identification of intermingled lesions in the presence of dense adhesions, and evaluation of subperitoneal lesions extent^(4,13,14). In the evaluation of deep endometriosis, MRI presents accuracy, sensitivity and specificity > 90%^(13,14). In the present iconographic essay, main MRI findings in deep pelvic endometriosis are described.

MRI PROTOCOLS

The acquisition of appropriate magnetic resonance images for evaluating patients with suspected deep pelvic endometriosis must follow specific protocols. In our clinics, the examination is performed during menses, with a full bladder. Additionally, immediately before the examination, a venous antispasmodic agent (dipyron, scopolamine butylbromide) is administered and, most recently, vaginal (50 ml) and rectal (100 ml) aqueous gel introduction has been adopted.

The protocol includes the following sequences: axial T1-weighted, and sagittal, coronal and axial T2-weighted; and, after intravenous gadolinium injection, axial, fat-suppressed T1-weighted sequences.

MRI FINDINGS

Imaging findings on MRI of patients with deep pelvic endometriosis depend on the type of the lesion: small infiltrative endometrial implants, deep, solid lesions and visceral endometriosis involving the rectal and vesical walls⁽⁴⁾.

MRI may be a limited method in cases where the endometriosis presents with small infiltrative implants. Especially in cases where the lesions are visualized as

whitish foci at laparoscopy, MRI may be negative. However, in some patients hyperintense foci may be characterized on fat-suppressed T1-weighted sequences, representing small areas of hemorrhage^(4,13,14) (Figure 1).

At MRI, deep, solid lesions affecting the posterior cul-de-sac (Figure 2) present low to intermediate intensity signal, with further hyperintense foci on fat-suppressed (blood) T1-weighted images, hyperintense

signal on T2-weighted images with variable contrast-enhancement after intravenous gadolinium injection. Hypersignal foci on T1-weighted images result from ectatic endometrial glands with hemorrhagic content surrounded by fibrotic tissue. The extensive fibrosis component (Figure 3) generally characterized in the histological study of these lesions is responsible by the variable post-contrast-enhancement^(4,7). Some foci of endometriosis

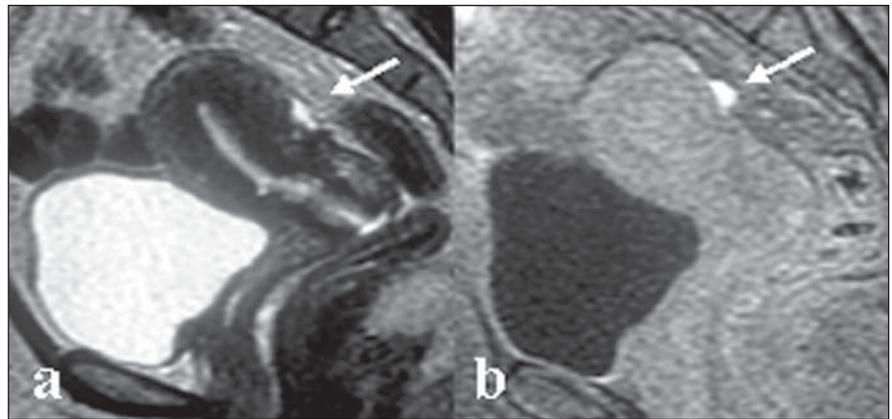


Figure 1. T2-weighted (a) and T1-weighted images with fat suppression (b) showing hemorrhagic peritoneal implant on the uterine serosa (arrows).

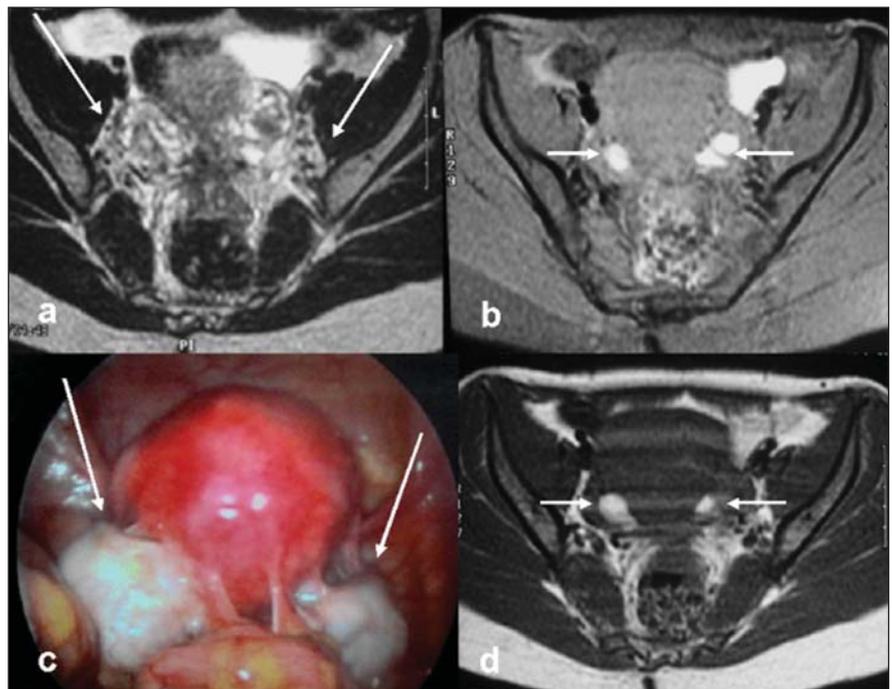


Figure 2. Axial, T2-weighted image (a), T1-weighted image with fat suppression (b) and T1-weighted image (d) show adhesion in the posterior cul-de-sac confirmed by laparoscopy (c). MRI shows posteromedially displaced ovaries with undefined cleavage plane between the uterine and rectosigmoid serosas, determining posterior cul-de-sac obliteration indicative of tethering process (long arrows). Additional findings: small endometriomas in the deep portion of both ovaries (short arrows).

localized in the Douglas cul-de-sac (Figure 4) may present with abundant glandular component with a mild fibrotic reaction. In these cases, high signal intensity is ob-

served on T1-weighted images, and variable signal intensity on T2-weighted images, with the solid glandular component demonstrating variable contrast-enhance-

ment after gadolinium injection^(4,8,14). In cases where the utero-sacral ligaments are involved (Figure 5), subtle signal intensity alterations are found at MRI; findings such

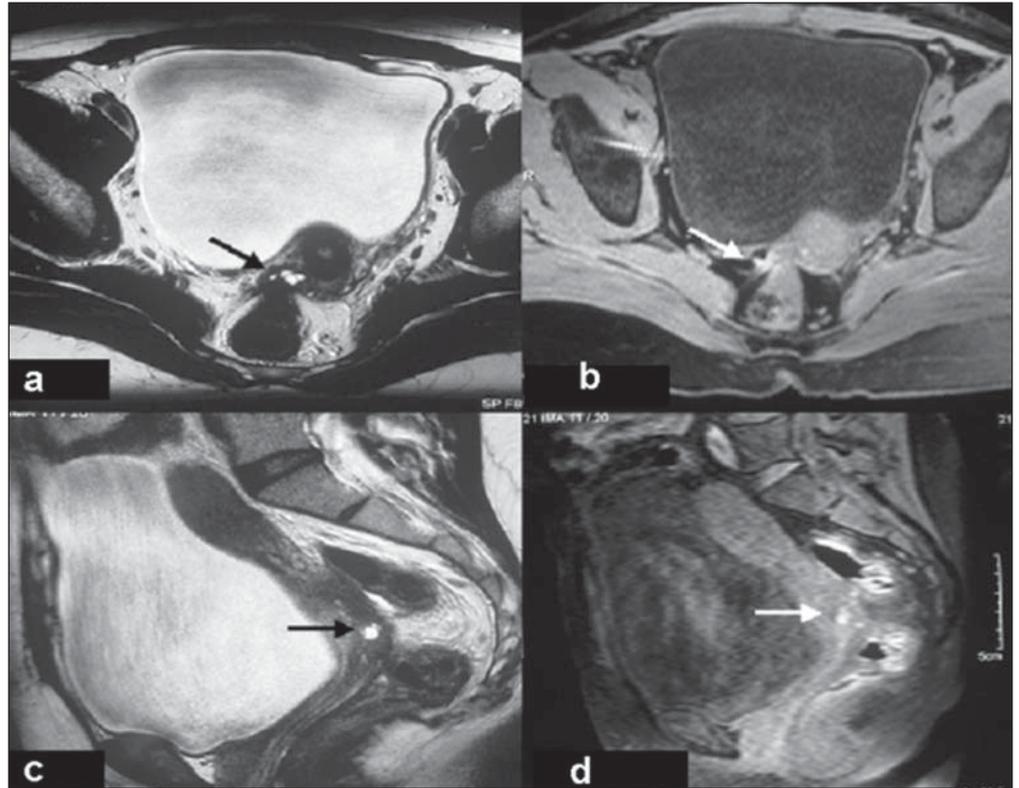


Figure 3. Axial, T2-weighted image (a), fat-suppressed T1-weighted image (b), and sagittal T2-weighted (c), and fat-suppressed T1-weighted (d) images show involvement of the utero-sacral ligament. MRI demonstrates isointense nodular lesion with spiculate margins on T1-weighted sequences, and hypointense lesion adjacent to the right utero-sacral ligament on T2-weighted sequences (arrows), with hyperintense foci on fat-suppressed T1-weighted sequences, indicating hemorrhage.

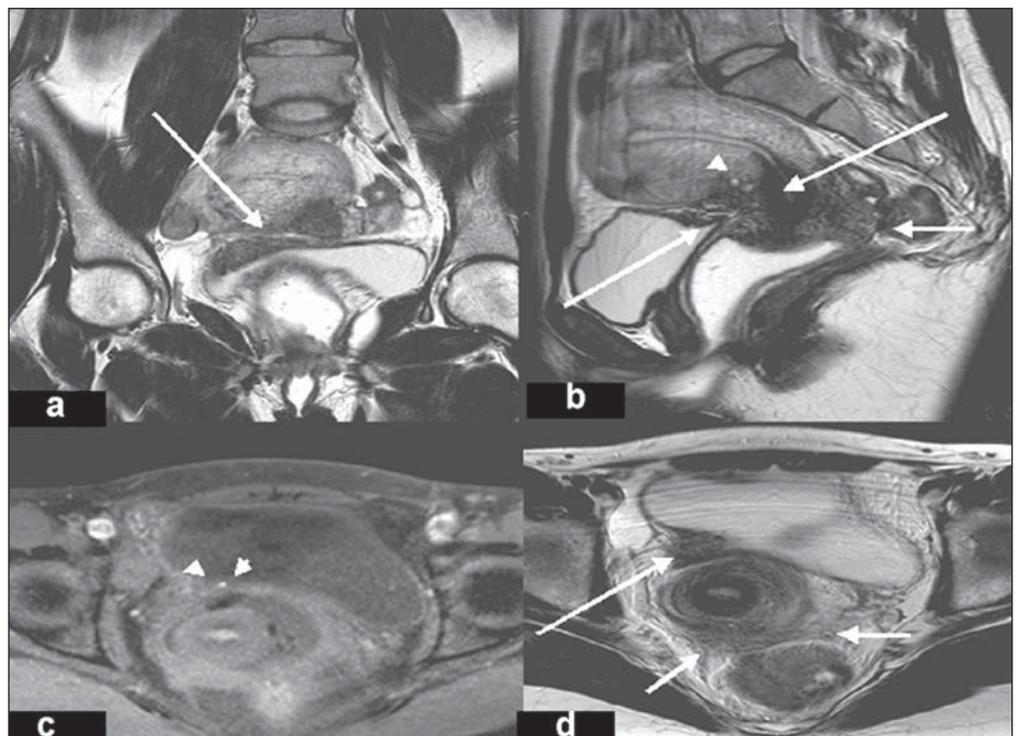


Figure 4. T2-weighted, coronal (a), sagittal (b) and axial (d) planes, and axial, fat-suppressed T1-weighted images demonstrating vesical endometriosis. A 32-year-old patient with pelvic pain during urination. MRI demonstrates deep vesical endometriosis in the vesicouterine, retrocervical septa, and upper portion of the rectovaginal septum. Hypointense nodular thickening on T2-weighted sequences, with partially defined margins, affecting the right, posterolateral part of the bladder and the corresponding vesicovaginal septum (long arrows); additionally, intermingled hemorrhagic foci (arrowheads) can be observed. In addition, hypointense nodular thickening is observed on T2-weighted sequences of the retrocervical region and right utero-sacral ligament, extending towards the vaginal fornix and upper portion of the rectovaginal septum (short arrows).

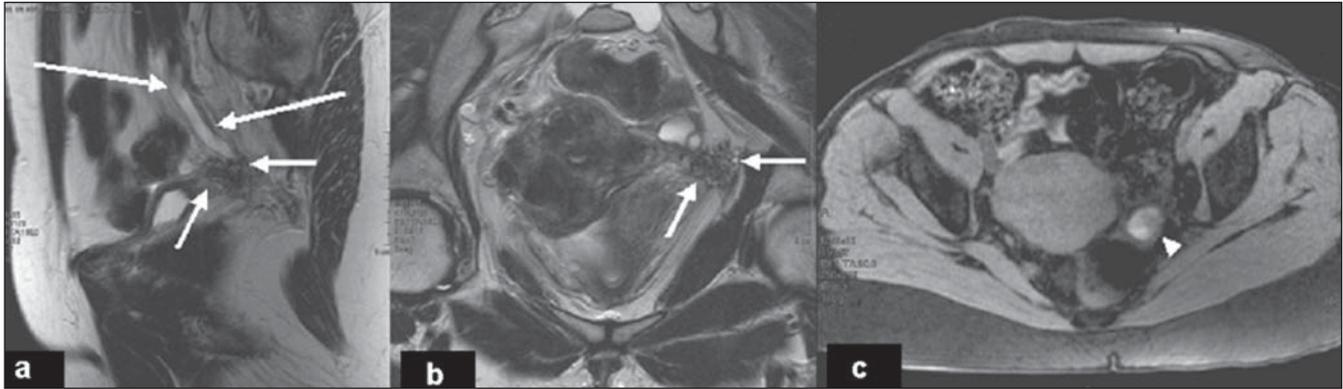


Figure 5. T2-weighted, sagittal (a) and coronal (b) images, and axial, fat-suppressed T1-weighted image (c) demonstrate ureteral endometriosis. MRI shows a hypointense, nodular lesion on T2-weighted sequences, with ill-defined margins (short arrows), and intermingled foci of bleeding (arrow head) extraperitoneally localized in the left pelvis, involving the pelvic portion of the ipsilateral ureter, determining upstream dilatation (long arrows).

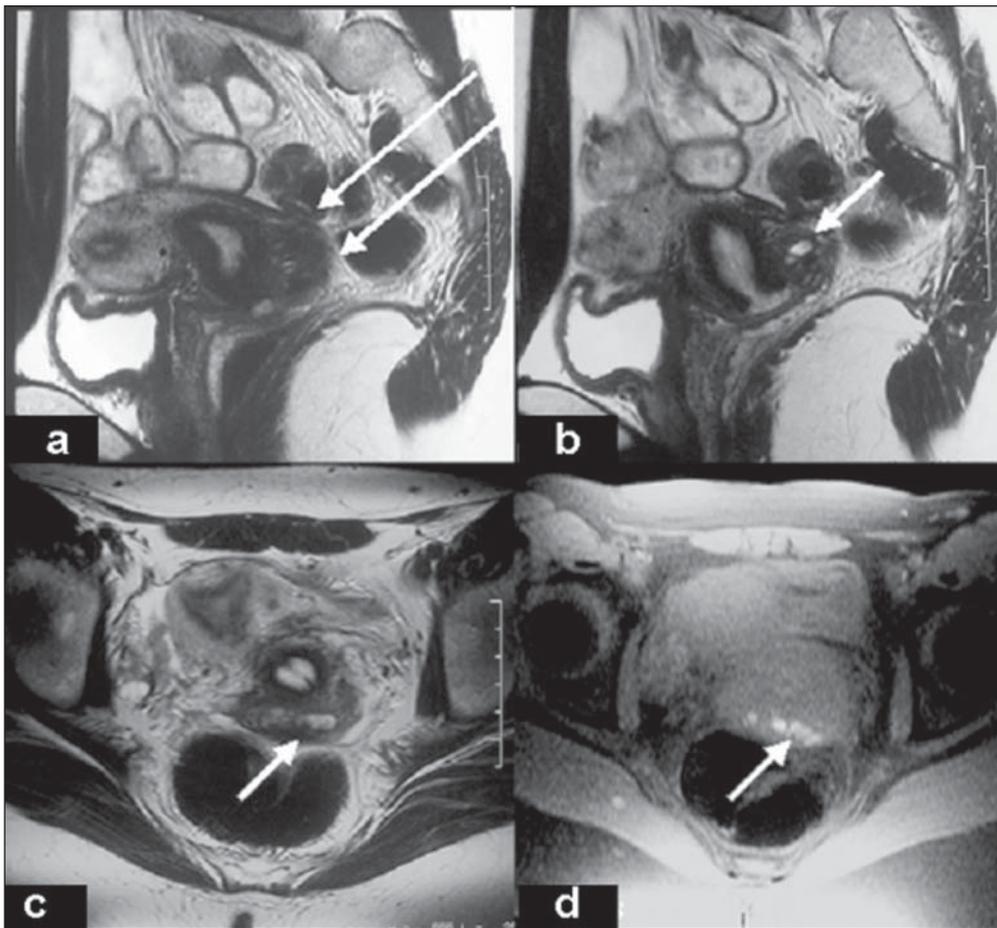


Figure 6. T2-weighted, sagittal (a,b), axial (c) images, and axial, fat-suppressed, T1-weighted image (d) demonstrate retrocervical endometriosis. MRI demonstrates hypointense nodular thickening in the retrocervical region on T2-weighted sequences (long arrows), presenting intermingled hyperintense foci on fat-suppressed T2- and T1-weighted sequences, characterizing ectatic endometrial glands with hemorrhagic content (short arrows).

as bilateral or asymmetrical thickening and nodularity within these ligaments should be taken into consideration^(4,8,14).

MRI may demonstrate focal or diffuse vesical involvement by endometriosis (Figure 6). The majority of patients present focal areas of parietal thickening with eventual hypersignal foci on fat-suppressed

T1-weighted images. Invasion of the mucosa is not frequent in cases of vesical endometriosis and MRI can demonstrate alterations even in cases of asymptomatic patients with normal cystoscopy^(4,8,13).

MRI sensitivity in the diagnosis of endometriosis with rectal involvement is relatively low, because of artifacts associated

with the rectal content. In our practice, vaginal and rectal introduction of aqueous gel immediately before the examination may improve the MRI accuracy in the evaluation of rectal and retrocervical lesions (Figure 7), lesions in the rectovaginal septum (Figure 8), and in the vaginal wall. Rectal involvement generally is demon-

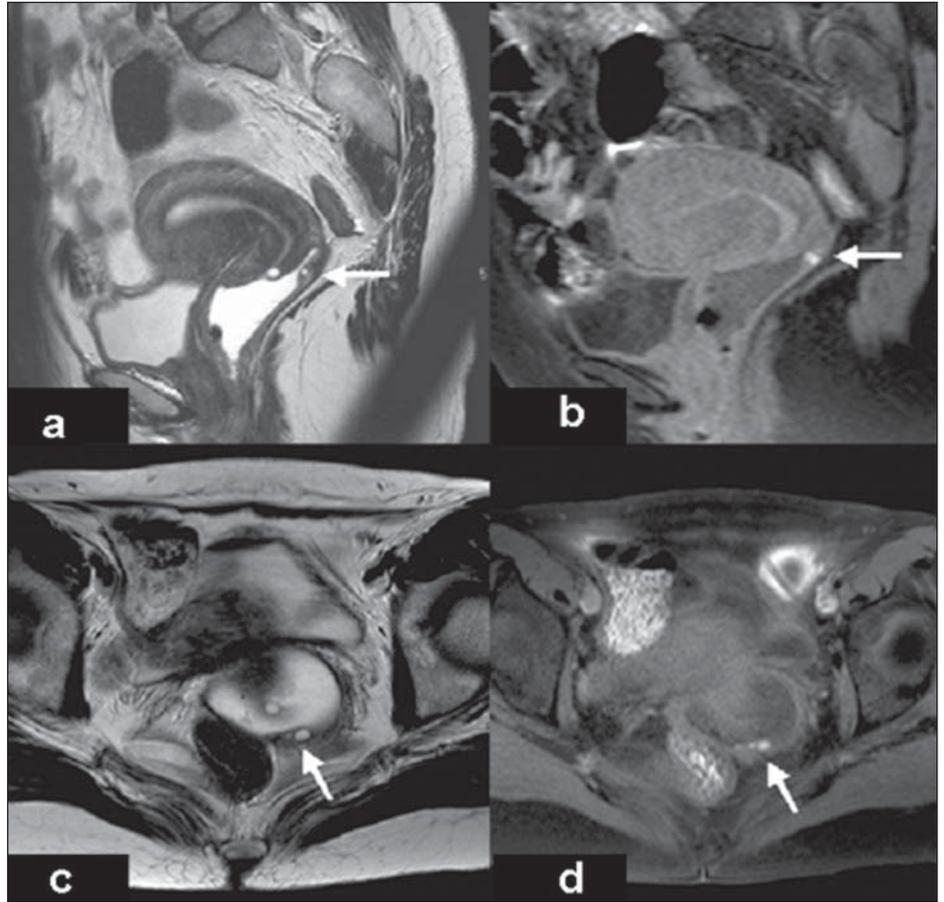


Figure 7. T2-weighted, sagittal (a) and axial (c) images, and fat-suppressed, T1-weighted sagittal (b) and axial (d) images show vaginal endometriosis. MRI demonstrates hypointense nodular thickening on T2-weighted sequences of the posterior wall of the deep portion of the vagina with intermingled foci of bleeding (arrows).

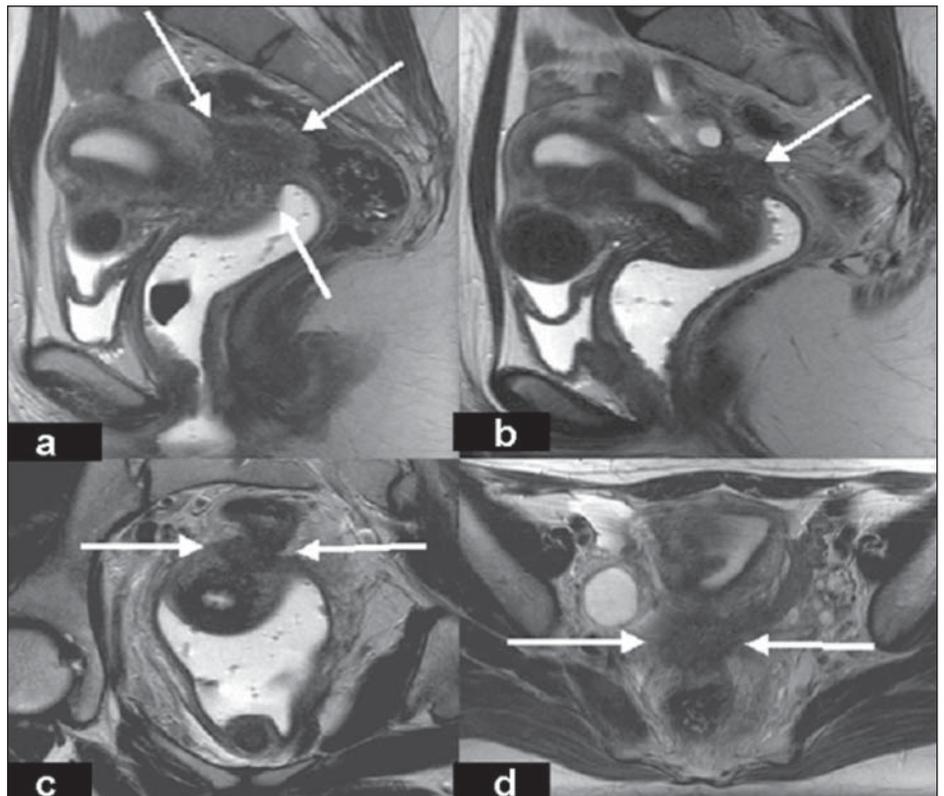


Figure 8. T2-weighted, sagittal (a,b), coronal (c) and axial (d) images demonstrate endometriosis involving the posterior compartment, vaginal fornix and rectovaginal septum. MRI shows hypointense, infiltrative, nodular lesion with ill-defined margins on T2-weighted sequences, affecting the retrocervical region, vaginal fornix, posterior cul-de-sac, anterior rectal wall, and upper portion of the rectovaginal septum (arrows). Additional findings: subserous myoma, focal adenomyosis of the anterior corpus region and cyst in the left ovary.

strated by MRI as a parietal thickening with hypointense signal on T2-weighted images. Hyperintense hemorrhagic foci may be identified on fat-suppressed T1-weighted images^(4,7,8,13).

CONCLUSION

In patients with deep pelvic endometriosis, clinical and sonographic results may be normal or poorly elucidative, difficulting the diagnosis determination. In these cases, MRI is essential for an accurate differential diagnosis. MRI can evaluate areas otherwise inaccessible by laparoscopy, identifying and evaluating the extent of lesions in the sub-peritoneal region and in the presence of dense adhesions. Because of its multiplanar capacity and excellent tissue characterization, MRI plays an essential role in the preoperative evaluation of patients with deep pelvic endometriosis.

Acknowledgements

The authors thank Dr. Cláudio Crispi, for kindly letting the author have the material utilized in the present study.

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