

Role of imaging in the preoperative assessment of pelvic and extrapelvic endometriosis: a pictorial essay

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Authors: M. Peri, F. Vernuccio, D. Picone, P. Purpura, G. Lo Re, G. La Tona, S. Salerno, A. Lo Casto; Palermo/IT
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Aims and objectives

-To create a MR radiological template for endometriosis

-To review MR reports and images in patients with endometriosis to assess the accuracy of the reports.

Methods and materials

Endometriosis, firstly described by John Sampson in 1921, and is characterized by the presence of ectopic endometrial tissue. If this latter is located within the uterine myometrium it is called adenomyosis or internal endometriosis; if it is outside uterus it is called endometriosis. This ectopic tissue is gonadic hormone responsive, as normal eutopic endometrial tissue: this phenomenon causes an inflammatory fibrotic reaction, which is responsible for the clinical symptoms [1]. Being often asymptomatic and sometimes "microscopic", its real incidence and prevalence are not definite. However, according to the Italian Agency for Medicinal Products,(1), the prevalence in asymptomatic women is around 2-22%, depending also on diagnostic criteria used. According to literature, endometriosis is found in 4.7 % to 50 % of women undergoing laparotomy for other diseases. On the other hand, its incidence is around 40-60% in women with pelvic pain and dysmenorrhea , while in infertile women its range varies from 20% to 30 % [10]. Though being one of the most studied and frequent gynaecologic disorder, its etiology is not completely known. The pathogenesis is most probably related to endometrial cells escape through the incision in the uterus and implant within the abdominal wound, particularly during surgical procedures that involve the uterus. Many theories try to explain its cytogenesis, but none of them justified the origin of the different forms of this disease. To date, the most widely accepted theory is that endometriosis results from metastatic implantation from retrograde menstruation, which assumes transportation of endometrial tissue from the uterus in a retrograde fashion into the peritoneum and its implantation on sierosal surfaces outside the uterus. However, this theory does not explain implantations outside peritoneum. The most common sites of implantation are ovaries, anterior and posterior cul-de-sac, uterosacral ligaments, posterior broad ligaments, uterus, fallopian tubes, sigmoid colon, ureter and small intestine. Other ectopic locations are bladder wall, appendix, cecum, kidney and abdominal scars. Rarely it has been reported in the lung, pleura and inguinal or pelvic lymph nodes.

Symptoms are not specific and include infertility and pelvic pain. The extent of endometriosis does not always correlate with the severity of symptoms, and this further complicates the diagnosis. Most common symptoms are severe dysmenorrhea (30-90 %

of cases), chronic pelvic pain (26-60 % of cases), deep dyspareunia (16-45 % of cases) , pain during ovulation or urinary/intestinal symptoms.

Hence, diagnosis can not rely just on clinical symptoms, this causing a delay in the diagnosis of the disease.[6]

Of the different classification systems, the most used is that of the American "American Society of reproductive Medicine" (ASRM, 1997), which considers extension, location and number of the lesions, classifying the disease in 4 stages [3].

Diagnosis can be made through an accurate anamnesis, laboratory tests, transvaginal/ abdominal ultrasound (US), computed tomography (CT), magnetic resonance (MR), laparoscopy and biopsy.

Among these, pelvic MR is having a more and more role in the diagnostic and therapeutic management.

Actually, radiologists have a valid diagnostic tools, through which they can diagnose, assess the extent and thus the severity of the lesions, thus providing a considerable contribute in the choice of medical and surgical treatments [7].

Results

Endometriosis is a more and more frequent disease in the clinical context, being often an incidental finding. Therefore, it is mandatory that the radiologist takes into account the diagnosis of endometriosis, mainly in women of childbearing age who perform imaging examinations without specific symptoms and signs, in women with chronic pelvic pain and infertility and in patients with already known endometrial lesions. In this latter situation, it is necessary to recognize the different characteristics of disease presentation and major development sites. Failure to recognize changes in some districts, leads to a significant delay in diagnosis and is crucial in the subsequent therapeutic approach (parametrial endometriosis can infiltrate the ureter and cause kidney dysfunction upstream). For this reason, the aim of our study was to retrospectively identify all cases of suspected, alleged or known endometriosis, and reconsider their diagnostic management. All reports of pelvic MR from 2011 to 2014 containing the term "endometriosis" were selected. All reports and images of selected MR were reviewed. MR reports and images of 53 patients (38,37±8,04 years old) with pelvic or extra-pelvic endometriosis were reviewed.

The MR studies had been performed on two 1.5 Tesla superconducting device. The administered paramagnetic intravenous contrast medium was Gadobenate-dimeglumine(Gd-BOPTA).

In 86,79 % of the patients the description of the absence/presence of involvement of one or more structure was missed. In 28,57% the lack of this information, such as the normal

or altered junctional anatomy of the uterus, the involvement of uterine ligaments (vesico-uterine and utero-sacral) , or even of the some recesses, as the recto-uterine septum and the vesicovaginal septum, whose involvement in the study of a woman with suspected endometriosis , especially in the form deep infiltrating endometriosis, must always be considered, may potentially have changed the operative assessment for the surgeon.

In light of the above data, the second purpose of this educational poster is to create a standardized report that could turn to be useful for the radiologist to detect, recognize and report all locations of the disease.

The role of the radiologist becomes predominant at this stage , as he has at his disposal the use of diagnostic tools (MR and CT), which allow to get an overview of the pelvic and abdominal anatomy, and to evaluate all the recesses and the anatomical structures , which are not easily accessible either with the trans-vaginal US or with laparoscopy [3].

Before evaluating endometriosis at imaging it is important to take into account some key features:

A) TYPE OF ENDOMETRIOSIS

According to an anatomo-pathological point of view endometriosis can be distinguished in

1) endometriotic implants and tissue adhesions. On MR , endometriotic implants have variable signal intensity, and can appear quite similar to normal endometrium (low signal on T1 and high T2) , may present hypointense or hyperintense on T1 and T2- weighted images , or hyperintense in T1 and hypointense on T2 .

3) endometriotic cysts have two different MR patterns of presentation : cysts with high signal intensity on T1 -weighted sequences and low signal intensity on T2 -weighted sequences , when the bleeding is in early subacute phase (less than 7 days); cysts with high signal intensity on both T1 -weighted sequences in T2 , when the bleeding is in late subacute phase (more than 7 days). An important feature is the endometrioma " shading" (signal loss within the lesion) in T2 -weighted images; it derives from the presence of blood products in various stages of degradation and reflects the active nature endometriomas in which you are experiencing repeated bleeding .

B) MACROSCOPIC FEATURES

- solid tissue nodules
- cystic lesions (mainly ovarian " chocolate cysts ")
- post adhesions and fibrotic tissue implants.
- Deep (Diffusely infiltrating deep endometriosis) .

C) INVOLVED SYTES AND ORGANS

-pelvic endometriosis

-extrapelvic endometriosis

With regard to the pelvic endometriosis in order to make more simple and immediate study of involved structures pelvis divide the space into three compartments:

ANTERIOR COMPARTMENT

-bladder and ureteral-bladder ostia

-vesicouterine septum

-vesicovaginal septum

MIDDLE COMPARTMENT

-Parametrium, uterus, uterine ligaments;

-ovaries and fallopian tubes

POSTERIOR COMPARTMENT

-torus uterinus and retrocervical area;

- uterosacral ligaments;

- vaginal fornix and rectovaginal septum;

-intestinal endometriosis (mainly rectum and sigma)

Bladder evaluation should be performed with filled bladder. In suspected intestinal localization (see Figure 1) it would be useful an accurate distension of the rectum and of the sigma.

A STRUCTURED REPORT

Imaging diagnostic techniques have three main goals:

- Diagnose and Localize all implants.
- support therapeutic choices through a multidisciplinary therapeutic planning;;
- assessment of pre - operative risk
- assessment of post-operative complications, if any.

MR PROTOCOL

MR imaging is an excellent way to identify the structural aspects and characteristics of the lesions. Furthermore, it is the optimal diagnostic method to make the " mapping " of all implants of endometrial tissue , thanks to the large field of view , the high spatial resolution and contrast. A proper management of the examinations requires a proper image acquisition. Pelvic MR is performed using at least a 1.5 -Tesla scanner. It is recommended fasting for at least 4 hours and a moderate bladder filling before the examination to correct the angle of uterine anteversion and dislocate the upper small intestine. A proper bowel cleansing should be performed through ingestion of an oral laxative, the day before the survey. A low fiber diet in the previous days is useful. In case of suspected intestinal involvement butylescopolamine can be intravenously injected to reduce bowel movements.

MR standard protocol includes axial, sagittal and coronal fast spin-echo T1 and T2-weighted images, also fat sat, T1-weighted gradient -echo in and out phase, and, if necessary, LAVA (GRE 3D T1 - post contrast after intravenous injection of gadolinium in a dose proportional to body weight). The average duration of the image acquisition RM is 45 minutes. In patients with lesions located near bladder, and extending to the region of the bladder floor in the peri - trigonal regione, with the possibility of ureter involvement, it would be useful to acquire an urographic phase through a volumetric 3D coronal T1 weighted gradient-echo sequence.

RADIOLOGICAL REPORT

the description of the findings by evaluating the different structures may be done in the following way:

- Uterus : flexion-version, size, morphology, rhyme and junctional zone .
- Annexes: location any strains and/or the presence of masses that cause their displacement), morphology, any fibrotic striae and peri-ovarian adhesions.
- Recesses : proceeding in the anteroposterior direction , the perivesical, vesico-uterine and vesicovaginal spaces, para-uterine spae and utero-rectal and recto-vaginal septa
- Parametrial (see Figure 2), uterine ligaments,
- Bladder: indicate filling, morphology, wall, any wall nodularity
- Presence/Absence of free fluid;
- Evaluation of main lymph nodes.

Regarding the assessment of the extra- pelvic locations, suspicion arises in the light of the anamnesis and knowledge of all the possible locations; hence, an accurate clinical

evaluation is mandatory. Based on these considerations, the different sites of implants must be considered in order of frequency: firstly abdominal wall endometriosis on surgical scar (see Figure 3), uretero - bladder district (see Figures 4 and 5), the chest wall and inguinal- femoral region.

Images for this section:

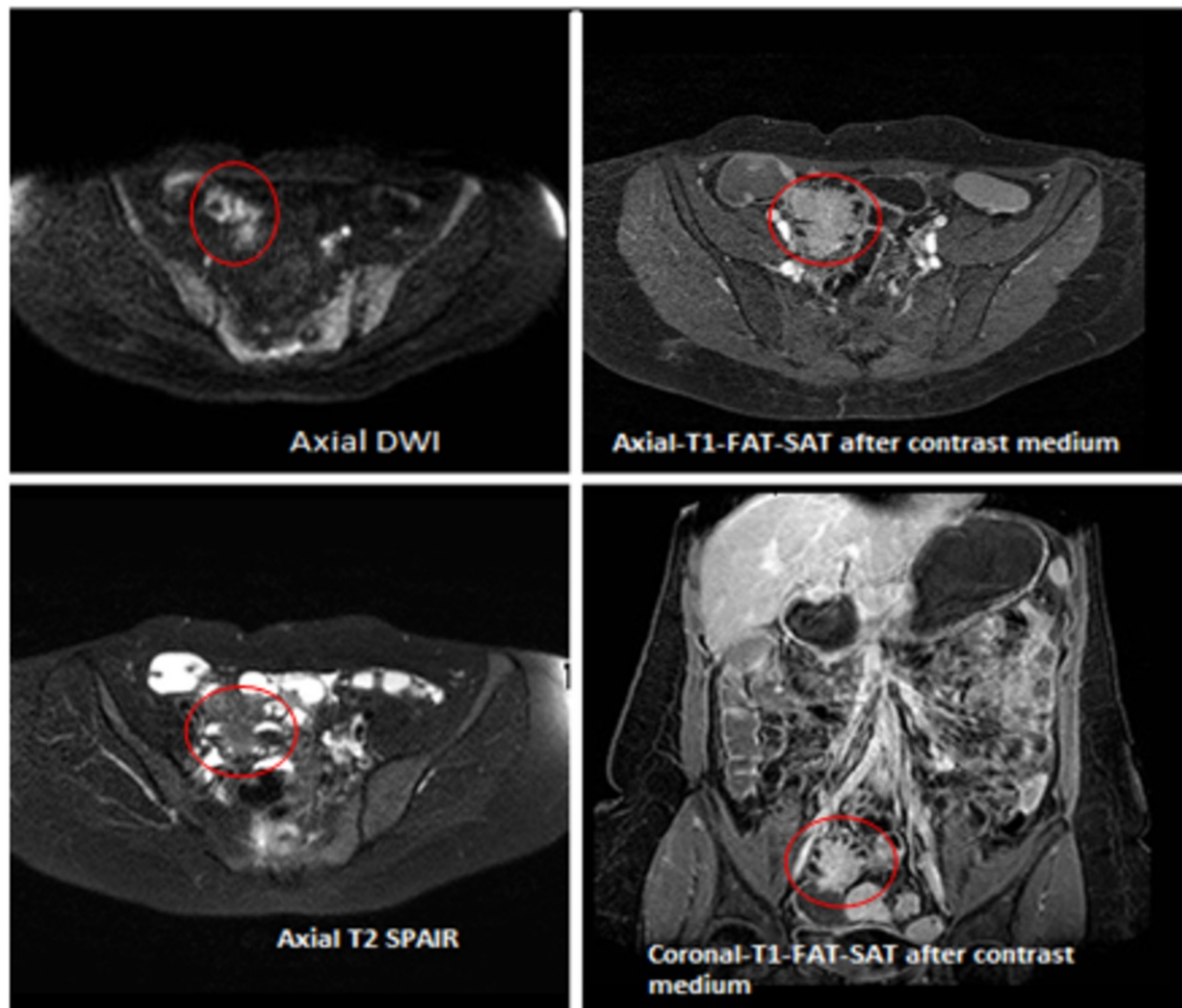


Fig. 1: Figure 1: MRI examination performed in a 37 years old female with an history of endometriosis after distension of bowel loops with 2 L of polyethylene glycol, before and after intravenous injection of contrast medium. The exam shows the presence of intestinal endometriotic tissue. This latter looks as nodule in the pelvis, in the right paramedian region, with spiculated margins, close to cecum wall, last ileal loop, some contiguous ileal loops and sigma. This tissue is hyperintense after intravenous contrast medium injection and shows restricted diffusion of water molecules in DWI.

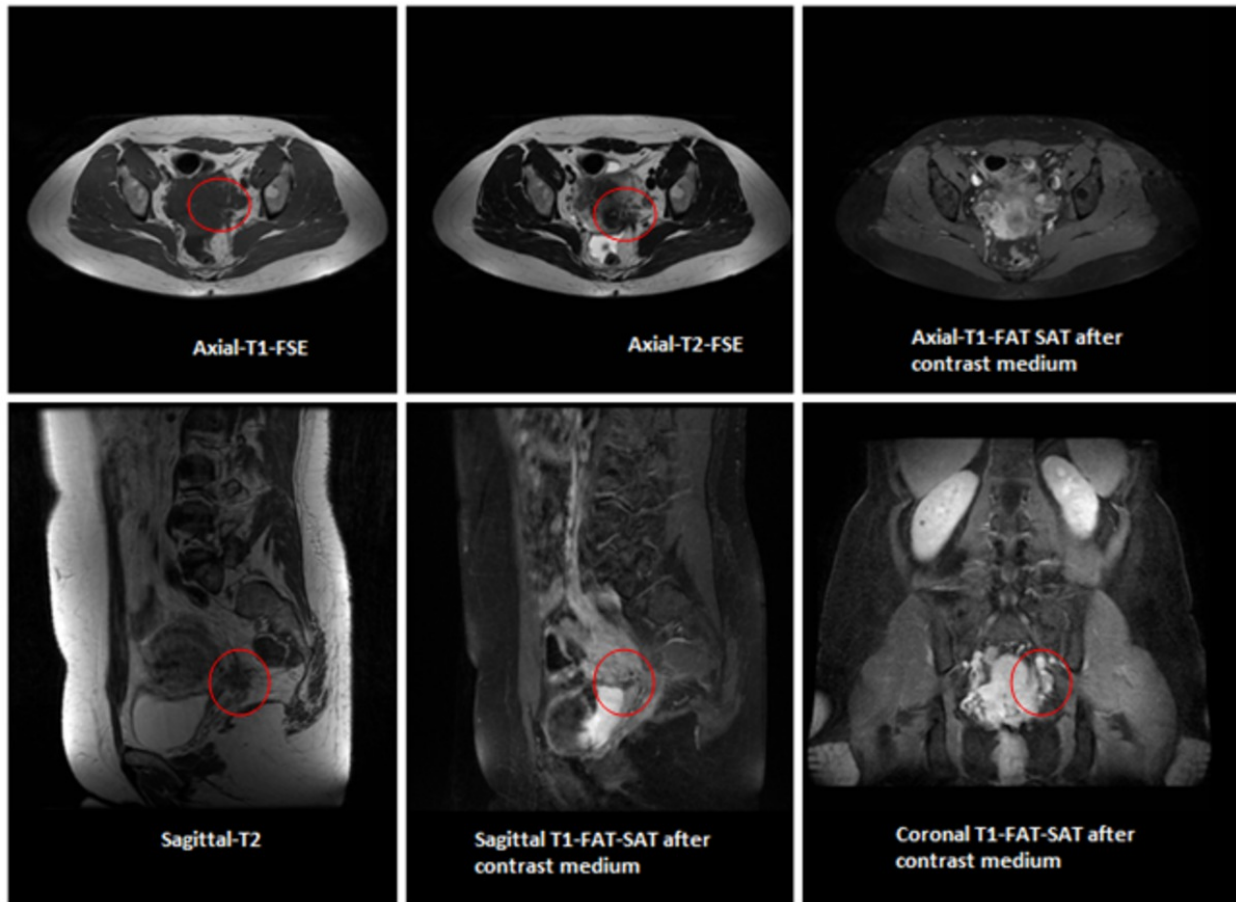


Fig. 2: Figure 2: MRI examination performed in a 52 years old woman before and after injection of 7 ml of contrast medium shows endometriosis in the left parametrium , adhesions with the posterior wall of the uterine cervix and distal pelvic tract of the left ureter. MR shows this parametrial endometriosis as ill defined- tissue with medium-low intensity on T1 weighted sequences , inhomogeneous due to the presence of intermediate-low intensity components on T2 weighted sequences, which moderately enhances after contrast medium injection.

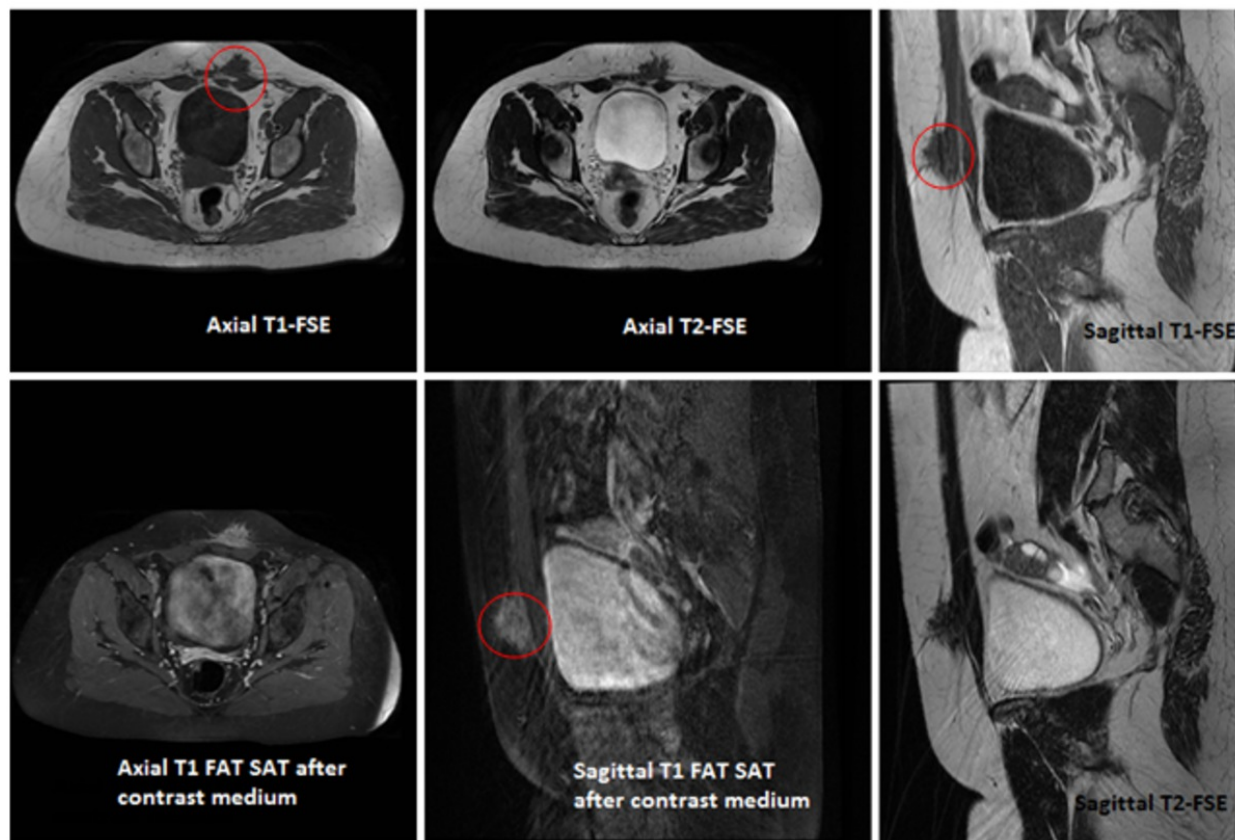


Fig. 3: Figure 3: MRI examination performed in a 45 years old woman before and after intravenous injection of 8 ml of contrast medium shows abdominal wall endometriosis. This latter is located in the left half of the anterior abdominal wall in the lower third of the rectal muscle fascia. It looks as an oval mass with irregular margins, intermediate-low intensity on T1, inhomogeneous on T2 and with high contrast enhancement.

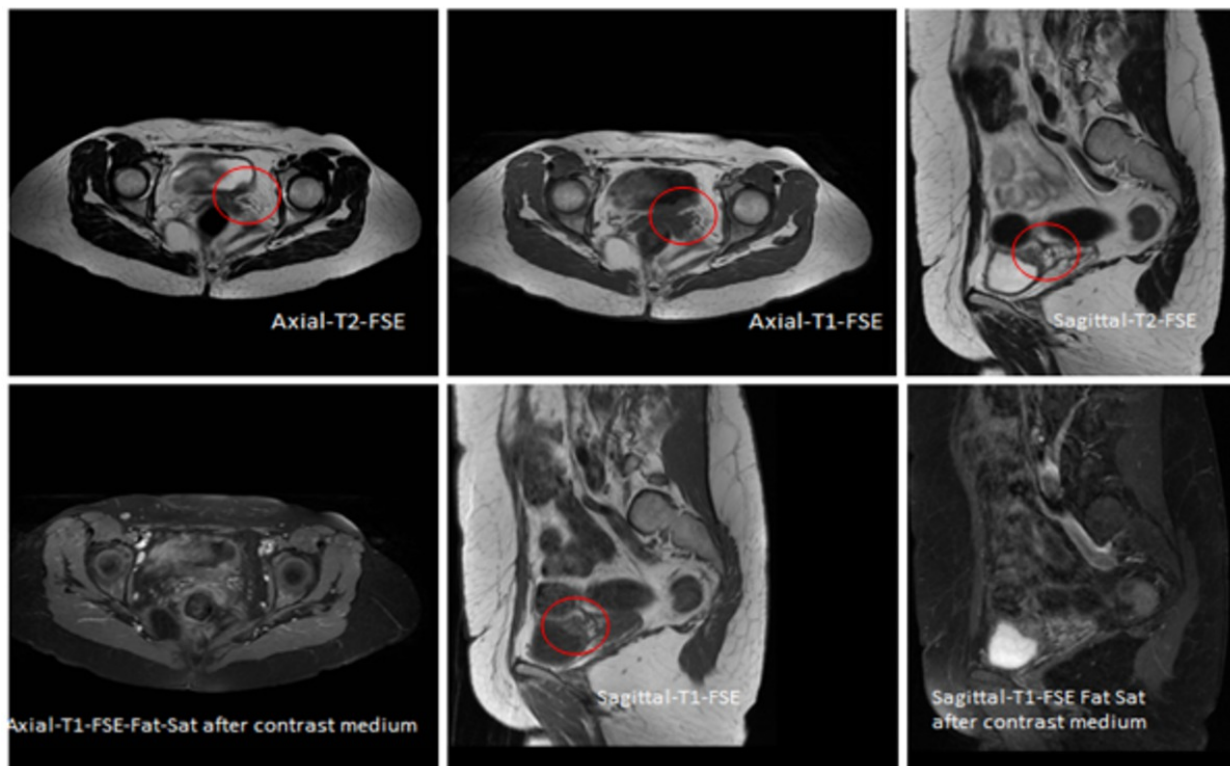


Fig. 4: Figure 4 MRI examination performed before and after intravenous administration of 6 ml of contrast medium in a 24-years-old female with a history of hysterectomy, right oophorectomy and endoscopic resection of bladder endometriosis. MRI shows endometriosis of the left profile of the postero-lateral bladder wall as an oval hypointense mass, with medium-low signal intensity on T1-weighted sequence, low on T2-w, and low contrast enhancement in the postero-lateral profile of bladder wall, next to anterior sigmoid wall and to the vagina. Moreover, there are fibrotic scarring phenomena and adhesions.

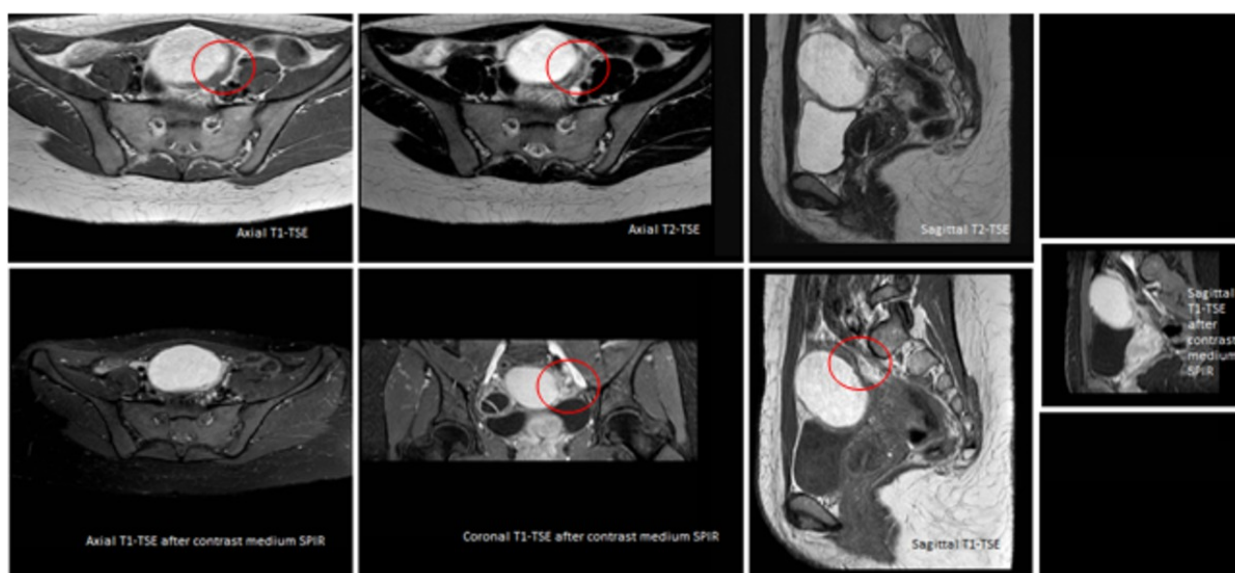


Fig. 5: Figure 5. Pelvic MRI performed in a 23 years old woman with pelvic endometriosis , involving the ureter and the rectovaginal space. Endometrial fibrotic adhesions encompasses the pelvic distal ureter in the juxta - bladder tract, which looks moderately dilated . This tissue has inhomogeneous signal intensity, medium-low in T1 , low on T2, without contrast enhancement.

Conclusion

Aim of our poster is to provide a methodology for the study of endometriosis, as a support for the radiologist. Thanks to the study of multi-parametric MRI radiologist's role in the management of female pelvic pathology, and in particular, in the study of endometriosis, is becoming increasingly important within a multidisciplinary team (radiologist, gynecologist, general surgeon, nephrologist). The goal is to lead a correct clinical- diagnostic - therapeutic management of a disease, which is often an incidental finding in clinical- radiological practice. Hence, in case of endometriosis diagnosed at MR, a complete radiological template should be kept in mind.

Personal information

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