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Latest MR imaging signs for the evaluation of ovarian and tubal endometriosis: A case series

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Abstract
Endometriosis of ovarian and tubal origin is a fairly common clinical condition. MRI is the only non invasive modality which is extremely sensitive to the diagnosis of this condition in the present age as compared to the previous era of laparoscopic diagnosis. This initiates the necessity to create awareness of these simple and diagnostic imaging signs on MR imaging. In our case series we have illustrated these MR imaging signs with short descriptions to confidently reach the diagnosis of ovarian and tubal endometriosis.

Keywords: MRI in Endometriosis, T2 shading, T2 dark spot, suppression on STIR.

Introduction
Endometriosis is defined as presence of ectopic endometrial glands and stroma located in extra-uterine locations. Initially it was thought that retrograde menstruation is the cause of endometriosis but the actual cause is still being researched upon [1]. There are three types of endometriosis. Superficial, ovarian and deep pelvic endometriosis. MR imaging is used for diagnosis of ovarian and deep pelvic endometriosis. It is not adequate for diagnosing the superficial variant of pelvic endometriosis. We list the imaging specific signs encountered on MR scans to differentiate various entities and establish the diagnosis of endometriosis of ovarian and deep pelvic forms. The gold standard for diagnosis of pelvic endometriosis is laparoscopic biopsy and histological analysis [2]. MR imaging signs do possess high percentage of sensitivity and specificity for endometriosis.

Materials and Methods
We have included 15 cases who were clinically suspected to have pelvic endometriosis. Plain MRI of the pelvis was performed in these patients using GE Optima 1.5T" machine. Standard body and pelvis coil was used for imaging in MRI. Standard sequences of MRI pelvis examination were included, which were T1W sagittal and coronal, T2W sagittal, coronal and axial, STIR coronal and axial, T1W FAT SAT axial and coronal, DWI and gradient echo sequences. In this series of 15 patients we would like to emphasize about the accuracy of the MRI signs most commonly encountered in endometriosis.

Observation
We would like to present the observations of our cases as a pictorial assay as radiology is a visual based medical science. We have elicited all the findings we encountered in our cases for easy understanding and accurate image interpretation. We would also be briefly explaining the MRI signs and explaining their cause.

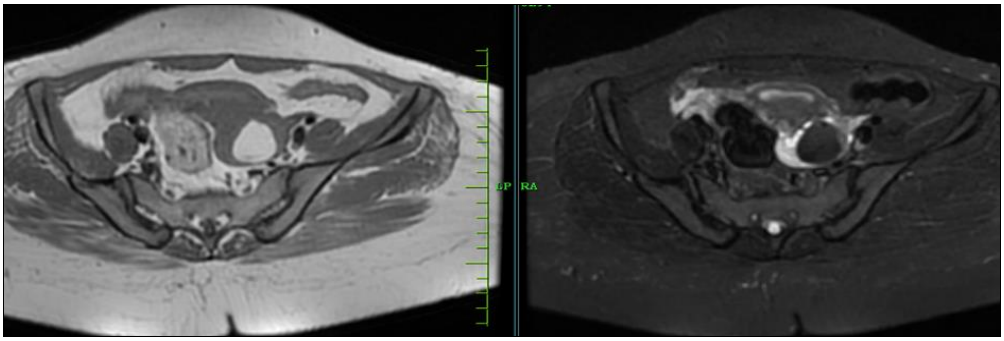

Fig 1: Stir suppression of blood products: These are axial sections of the pelvis from T1WI and STIR suppression sequences. The T1W images shows a well-defined, hyperintense signal intensity area within the left enlarged ovary which represents the blood degradation products of an endometrioma. The STIR image demonstrates suppression of the blood products causing hypointense signal in the corresponding region. This is known as STIR suppression. It is observed that STIR suppression is not specific for fat which is commonly seen in ovarian dermoids but is also elicited by ovarian endometriomas. Suppression of T1 signal hyperintensity on STIR is seen in both fat and blood products.

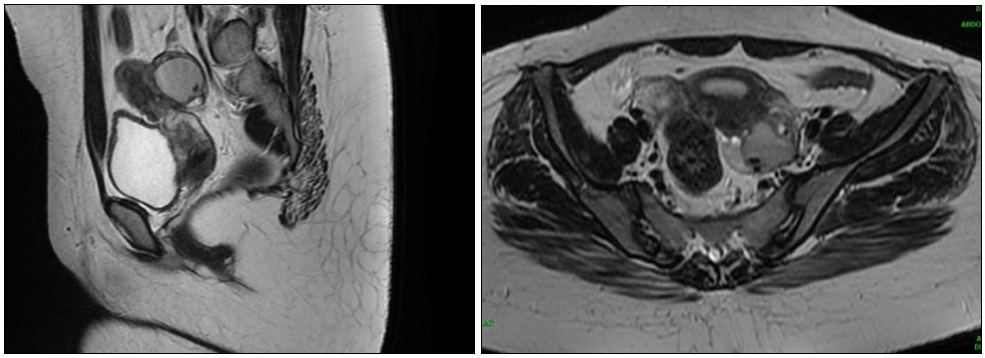

Fig 2: "T2 dark spot": These are sagittal and axial images from a T2W sequence. These demonstrate dependant, discrete, markedly hypointense foci abutting the wall of the cyst. This sign is the most sensitive sign of a chronic haemorrhage and hence an endometrioma on T2WI.

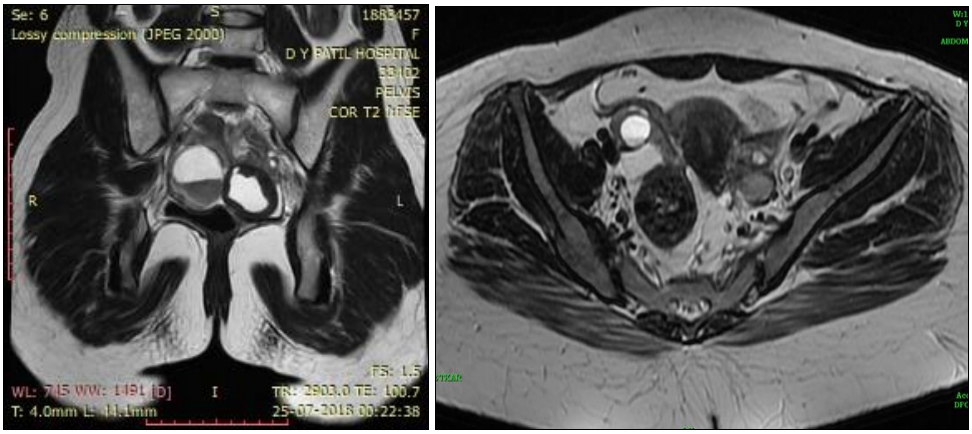

Fig 3 : "The T2 shading sign": These are coronal and axial images of a T2W sequences. There are well-defined, hyperintense ovarian cysts which show dependant, layering, hypointensities within.

Fig 4: These are axial and coronal images of a T1W sequence: These images demonstrate bilateral, dilated, fallopian tubes. The content within the dilated fallopian tubes is hyperintense which is suggestive of blood products. These images demonstrate bilateral hematosalpinx.

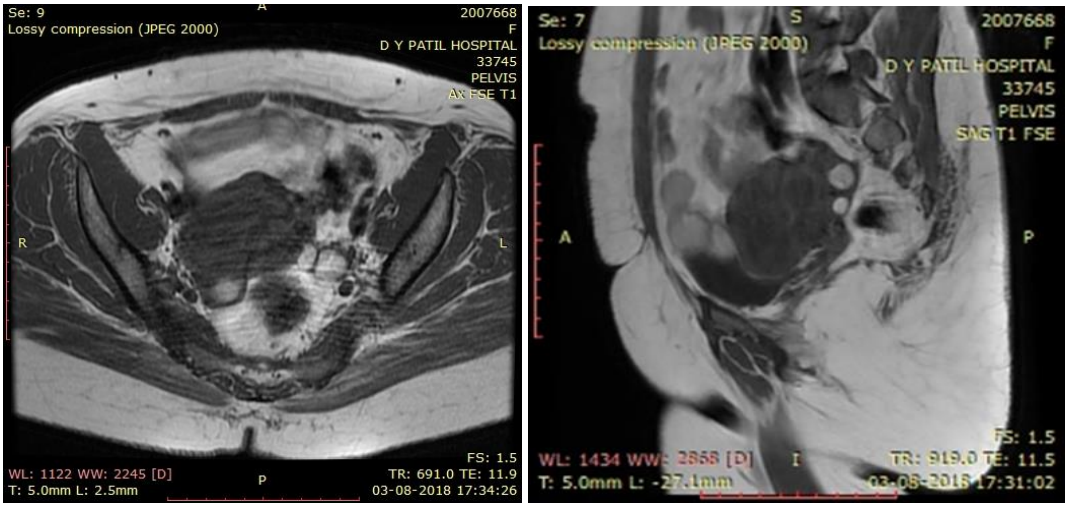

Fig 5: These are axial and sagittal images of a T1W sequence: These images demonstrate bilateral, multiple cysts with hyperintense content. Multiplicity and bilaterality of adnexal cysts indicates endometriomas. In addition multiple ovarian cysts with T1 high signal intensity are also sensitive markers of endometriomas.

Discussion

Endometriosis is a common condition encountered in women of reproductive age group. Mean age of diagnosis is 25-35 years of age [3]. Primary infertility and chronic pelvic pain remain the commonest symptoms of presentation [4]. The commonest location for endometriosis is the ovaries followed by the pelvic peritoneum which is known as deep pelvic endometriosis. In deep pelvic endometriosis the peritoneal reflection forming the recto-uterine pouch and the uterosacral ligaments are most frequently involved [5]. Deep pelvic endometriosis is suggested to be the cause of the two commonest symptoms in patients which are deep pelvic pain and infertility [6]. Surgical excision and hormonal therapy remains the main approach to therapy [7].

MR imaging is proved to be a sensitive tool to diagnose endometriomas. It can diagnose endometriomas due to their high viscous nature, high protein content and repeated haemorrhages which lead to T1 and T2 shortening effects on MR imaging [8]. In our study we observed five imaging signs on MRI which were consistently present and aided in confident diagnosis. "STIR suppression in endometriomas" was seen in all our cases. Earlier it was a specific sign for fat within a lesion but newer research has shown that it is also elicited by blood products. STIR is abbreviation for "short inversion time inversion recovery". Suppression of T1W hyperintense signal on STIR is elicited by fat, hemorrhagic ovarian cysts and endometriomas [9]. The second sign which is the most specific sign for an ovarian endometrioma is "T2 dark spot". There is a hypointense spot/focus on T2W images seen within the ovarian cyst abutting the wall of the cyst. It is due to fibrous content of the wall and hemosiderin laden macrophages [10]. T2 dark spots are highly specific for chronic haemorrhage and can distinguish between endometriomas and haemorrhagic cysts with a specificity of 93% [11]. "T2 shading sign" of endometriomas was also seen in all of our cases on the study. Endometriomas have lower T2 signal intensities (T2 shortening effects) [12]. These are usually seen along the dependant portions of the cysts as layering dependant hypointensities. This occurs due to the content of the endometriomas which are more viscous and contain high concentration of protein and iron due to recurrent haemorrhage [13]. This sign is sensitive but not specific for endometriomas as is also seen in haemorrhagic ovarian cysts [14]. MR imaging is a non-invasive modality to diagnose the exact size and extent of dilatation of fallopian tubes. "Hematosalpinx" is specific for pelvic endometriosis. Evidence of high signal on T1W sequences within dilated fallopian tubes is a very sensitive marker to diagnose pelvic endometriosis [14]. The endometrial implants are located along the serosal surface of the fallopian tubes which cause adhesions and tubal obstruction [15]. In our study we encountered one case which demonstrated multiple ovarian cysts which were hyperintense on T1W images. In a study conducted by Togashi *et al*. he stated that an adnexal mass with high signal intensity on T1WI and multiplicity are both indicative of ovarian endometrial disease [16].

Conclusion

MR imaging is a non-invasive tool to provide accurate extension of disease process. Although laparoscopy is of gold standard for the diagnosis, the newer MR imaging signs are reliably sensitive and specific to diagnose pelvic and ovarian endometriosis.

Conflicts of Interest: The authors would like to confirm there are no conflicts of interests present.

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