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MRI Imaging Patterns in Rare and Atypical Presentations of Endometriosis

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ABSTRACT
Endometriosis is a chronic, estrogen-dependent condition that affects 10–15% of reproductive-aged women and up to 50% of those with infertility. While classical pelvic endometriosis is well studied, rare and atypical presentations such as polypoid endometriosis, deeply infiltrating endometriosis (DIE), and extrapelvicmanifestations remain underdiagnosed. MRI has emerged as a reliable, non-invasive modality for evaluating both typical and atypical forms of the disease. This observational study was conducted at Sree Mookambika Institute of Medical Sciences, Tamil Nadu, from August 2024 to February 2025. Thirty women, aged 20-45 years with suspected or confirmed endometriosis underwent MRI evaluation. Imaging protocols included T1-weighted (with and without fat suppression), T2-weighted, and diffusion-weighted sequences. MRI findings were correlated with clinical symptoms and, when available, histopathological confirmation. The most common clinical symptoms were dysmenorrhea (83.3%), dyspareunia (50%), and infertility (40%). MRI revealed T2 shading in 66.7% of cases, T2 dark spot sign in 50%, DIE in 60%, andextrapelvic lesions in 16.7%. Frequent lesion sites included the ovaries (73.3%), rectosigmoid colon (26.7%), diaphragm (10%), and abdominal wall (6.7%). Histopathology confirmed fibrotic nodules (60%) and hemorrhagic foci (40%). MRI effectively demonstrated lesion composition, distribution, and treatment response. MRI is a powerful tool for identifying rare and atypical endometriotic presentations. Integrating advanced imaging protocols can improve diagnostic accuracy, reduce delays, and enhance surgical planning and treatment monitoring.

INTRODUCTION

Endometriosis is a chronic, estrogen-dependent gynecological disorder affecting women of reproductive age, often causing pelvic pain, dysmenorrhea, dyspareunia, and infertility. It is typically found in the ovaries, uterosacral ligaments, and peritoneum, but rare and atypical presentations like polypoid endometriosis, deeply infiltrating endometriosis (DIE), and extrapelvic manifestations are becoming more common[1]. The pathogenesis of endometriosis is complex and incompletely understood, with Sampson's theory being the most accepted. Other theories include coelomic metaplasia, lymphatic and vascular dissemination, and stem cell differentiation. Magnetic resonance imaging (MRI) has emerged as a non-invasive, sensitive diagnostic tool for endometriosis, allowing for the diagnosis of hemorrhagic contents, fibrosis, and disease extent, providing crucial preoperative information[2].

Endometriosis affects 10-15% of women of reproductive age and up to 50% of those with infertility. Despite its prevalence, diagnostic delays of 7-10 years are common due to symptom variability and imaging limitations. Rare and atypical presentations, such as extrapelvic disease, are less common but clinically significant. Thoracic endometriosis syndrome, involving the diaphragm, pleura, or lungs, accounts for about 1% of cases. Abdominal wall endometriosis, often following cesarean sections, is rare but increasingly reported. Deeply infiltrating endometriosis (DIE), which invades more than 5 mm beneath the peritoneum, is observed in up to 20% of women with severe pelvic pain and is associated with extensive adhesions, ureteral obstruction, and reduced quality of life[3,4].

MRI is increasingly recognized for its role in identifying classical and non-classical presentations of endometriosis. T1-weighted images (T1WI) with and without fat suppression and T2-weighted images (T2WI) are particularly useful in detecting hemorrhagic and fibrotic components, respectively. Key features on MRI include the "T2 shading sign," which reflects chronic bleeding within endometriomas, and the "T2 dark spot sign," which indicates blood clots and high specificity for endometriomas[5,6]. In cases of deeply infiltrating endometriosis, MRI can demonstrate hypointense fibrotic nodules involving the rectovaginal septum, uterosacral ligaments, and bowel wall. Studies have shown that MRI can achieve up to 90% sensitivity and 95% specificity for detecting deep intrauterine infiltration (DIE) in experienced hands. Polypoid endometriosis, a rare variant characterized by exophytic growth resembling malignancy, is another important atypical manifestation. However, many atypical cases of endometriosis are underdiagnosed or misdiagnosed due to lack of awareness or inadequate imaging protocols. This highlights the need for systematic imaging strategies and inclusion of rare patterns in radiological differential diagnoses[7].

MRI has shown promise in evaluating classical endometriosis, but its role in diagnosing rare and atypical presentations is underexplored in clinical settings, especially in resource-constrained environments. The lack of standardized protocols for detecting unusual forms like polypoid endometriosis, thoracic endometriosis, and DIE involving bowel and urinary tract structures necessitates further investigation. This study aims to improve diagnostic accuracy by identifying and characterizing rare imaging patterns, reducing diagnostic delay and enhancing preoperative planning. Recognizing these imaging patterns can lead to more targeted therapeutic strategies. The current literature mainly focuses on ovarian and peritoneal endometriosis, with a lack of comprehensive data on less common variants, especially in the Indian subcontinent. The findings can be used to train radiologists and gynecologists in identifying rare forms of endometriosis and standardizing MRI protocols.

Aim and Objectives:

To investigate the MRI imaging patterns in rare and atypical presentations of endometriosis and assess their diagnostic value in identifying unique and less common features of the disease.

- To analyze the characteristic MRI findings associated with rare and atypical forms of endometriosis, including polypoid and extrapelvic manifestations.
- To evaluate the distribution of lesions in various anatomical locations and their correlation with clinical symptoms.

MATERIALS AND METHODS

Study Design and Setting: This observational study was conducted at Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanniyakumari, Tamil Nadu. Ethical clearance for the study was obtained from the Institutional Ethics Committee. The study was conducted over a periodof 7 months from Aug 2024 to Feb 2025.

Study Population: A total of 30 female patients, aged between 20-45 years, presenting with suspected or confirmed endometriosis based on clinical symptoms such as dysmenorrhea, dyspareunia, and pelvic pain, were included in the study. Written informed consent was obtained from all participants prior to their inclusion.

Inclusion Criteria:

- Female patients of reproductive age with a clinical suspicion of endometriosis

- Patients referred for MRI imaging for further evaluation
- Willingness to participate and provide informed consent

Exclusion Criteria:
- Patients with contraindications to MRI
- Individuals with a history of prior pelvic surgery altering the anatomy
- Pregnant women

Imaging Protocol: All MRI scans were performed using 1.5 Teslascanner. The imaging protocol included the following sequences:

- T2-weighted images in axial, sagittal, and oblique axial planes.
- T1-weighted images with and without fat suppression.
- Additional diffusion-weighted imaging (DWI) for suspected malignant cases.

Patient preparation included fasting for 3–6 hours, bladder emptying 1 hour before the scan, and the administration of an anti-peristaltic agent (unless contraindicated) to reduce bowel motion artifacts.

Data Collection: MRI findings were evaluated to identify imaging patterns associated with rare and atypical presentations of endometriosis, such as T2-shading, T2 dark spot signs, polypoid lesions, and deeply infiltrating endometriosis (DIE). The observed locations (e.g., ovaries, rectosigmoid colon, diaphragm) and associated conditions were documented.

Outcome Measures: The primary outcomes were the frequency and type of atypical MRI patterns, while the secondary outcomes included the distribution of lesion locations and associated conditions, such as adenomyosis or adhesions.

Statistical Analysis: Descriptive statistics were used to summarize baseline characteristics and imaging findings. Results were presented as mean ± standard deviation (SD) for continuous variables and frequency (%) for categorical variables.

RESULTS AND DISCUSSIONS

This study aimed to explore the MRI imaging characteristics of rare and atypical presentations of endometriosis in a cohort of reproductive-aged women. The findings underscore MRI's role in detecting complex, extrapelvic, and deeply infiltrating lesions, many of which are frequently missed on routine clinical or sonographic evaluation. Our observations have been compared with previously published original studies to contextualize the relevance and implications of our data.

In our study, the majority of patients belonged to the 20–30 years age group, with dysmenorrhea (83.3%), dyspareunia (50%), and infertility (40%) being the most common clinical complaints. These findings are in concordance with the study by Ballard *et al*.[8] (2008), who noted that severe dysmenorrhea and infertility are hallmark symptoms among women with deep and atypical endometriosis, often prompting advanced imaging for diagnosis.

Similarly, Vercellini *et al*.[4] (2007) highlighted that infertility is often associated with more extensive pelvic involvement, including deep infiltrating endometriosis (DIE), which was also significantly prevalent in our cohort (60%). Our results reinforce the notion that atypical or extensive disease burden correlates with more severe symptomatology.

T2 shading was identified in 66.7% of cases, while the T2 dark spot sign was observed in 50%. These signs are well-documented in the literature as being highly suggestive of chronic hemorrhage and blood clots within endometriomas. In a pivotal study by Tanaka *et al*.[9] (2010), the T2 shading sign had a sensitivity of 93% for detecting endometriomas. Our data are consistent with these observations, suggesting that these MRI features remain reliable indicators even in atypical or mixed morphologies.

Takeuchi *et al*.[8] (2022) further described the "dark spot sign" as having high specificity (93%) for intracystic blood clots and hemosiderin deposits. We observed this feature most commonly in lesions with suspected polypoid transformation, supporting its diagnostic value in identifying hemorrhagic and chronic-phase disease.

Deep infiltrating lesions were found in 60% of our cases, particularly in the uterosacral ligaments, rectovaginal septum, and bowel. These findings are aligned with the work of Bazot *et al*.[10] (2004), who demonstrated that MRI had a diagnostic sensitivity and specificity of over 85% in detecting DIE involving these anatomic sites. Our study also found that DIE lesions were more likely to be associated with infertility and pelvic adhesions.

In a more recent study by Thomassin-Naggara *et al*.[11] (2008), dynamic contrast-enhanced MRI helped delineate the extent of DIE with increased accuracy, especially in the rectosigmoid area. Although contrast was not used in our protocol, our T2-weighted and fat-suppressed images adequately delineated nodular and fibrotic lesions consistent with DIE, reaffirming the utility of basic MRI sequences when enhanced imaging is not feasible.

Extrapelvic involvement was seen in 16.7% of cases, including diaphragmatic and abdominal wall lesions. Diaphragmatic nodules appeared hyperintense on T1-weighted imaging and were associated with catamenial symptoms in some patients. These findings support earlier work by Alifano *et al*.[12] (2007), who

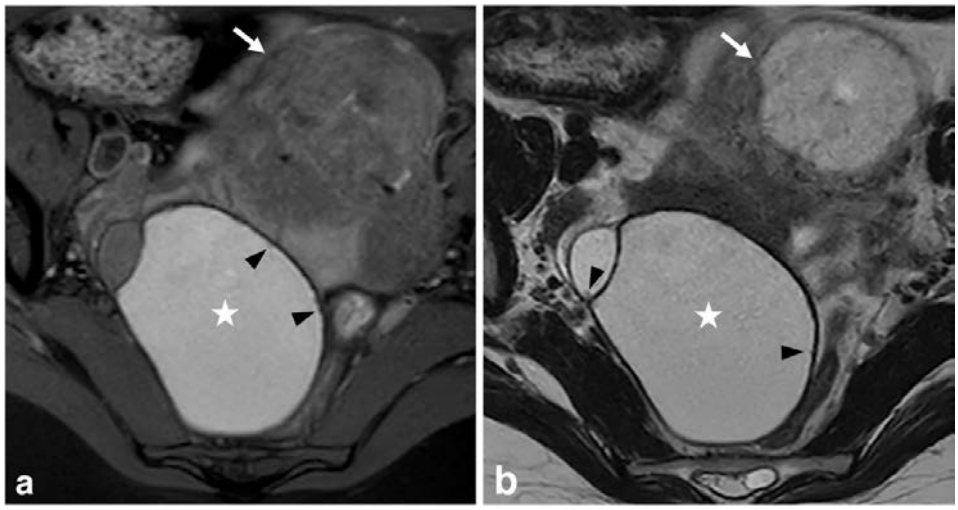

Fig .1: Axial T2-weighted MRI showing a hyperintense cyst with T2-shading in the left ovary, indicative of chronic hemorrhagic content

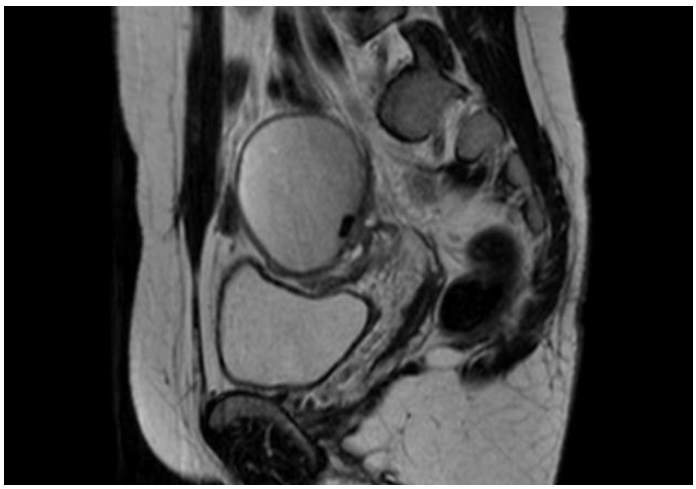

Fig. 2: Sagittal T2-weighted image showing a well-defined dark focus within an endometriotic cyst-T2 dark spot sign-suggesting the presence of blood clots.

Table 1: Demographics and Clinical Symptoms

Parameter	Frequency (n=30)	Percentage (%)
Age Group (years)		
20–25	6	20.0
26–30	4	13.3
31–35	10	33.3
36–40	7	23.3
41–45	3	10.0
Mean Age (± SD)	32.1 ± 6.4 years	
Parity		
Nulliparous	18	60.0
Multiparous	12	40.0
Clinical symptoms		
Dysmenorrhea	25	83.3
Dyspareunia	15	50.0
Infertility	12	40.0

Table 2: MRI Imaging Patterns

MRI Feature	Cases (n=30)	Percentage (%)
T2-Shading	20	66.7
T2 Dark Spot Sign	15	50.0
Deep Infiltrating Lesions (DIE)	18	60.0
Extrapelvic Endometriosis	5	16.7

described MRI as a sensitive tool for diagnosing thoracic endometriosis, often presenting as catamenial pneumothorax or shoulder pain.

Abdominal wall endometriosis was seen in two patients, typically located near surgical scars. Ueda *et al*. (2005) described the "gorgon sign"- spiculated or radial fibrotic strands within the lesion as characteristic of scar endometriosis, which we observed in both cases. These results validate MRI as the preferred modality for assessing scar-related endometriosis due to its superior soft tissue contrast. Polypoid lesions were identified in three cases and presented a diagnostic challenge due to their resemblance to malignancy. On MRI, these lesions exhibited heterogeneous enhancement, mimicking neoplastic processes. Parker *et al*.[13] (2004) first reported polypoid endometriosis as a mass-forming variant that histologically mimics endometrioid carcinoma. Our study echoes this concern, emphasizing the need for MRI-histopathological correlation in cases with suspicious features.

Takeuchi *et al*.[8] (2022) also reported that the lack of diffusion restriction and presence of internal T2 hypointense fibrotic components favored a benign polypoid endometriotic origin. Our study supports

Table 3: Locations of Atypical Endometriosis

Location	Cases (n)	Percentage (%)	MRI Observations
Ovaries	22	73.3	Multiplicity of cysts noted
Rectosigmoid Colon	8	26.7	"Mushroom Cap" sign observed
Diaphragm	3	10.0	Hyperintense nodules seen on T1WI
Abdominal Wall	2	6.7	Gorgon sign noted on MRI

Table 4: Histopathological Correlation

Histological Feature	Cases (n)	Percentage (%)	Comments
Fibrotic Nodules	18	60.0	Correlated with T2 hypointense regions
Hemorrhagic Foci	12	40.0	Detected as hyperintense on T1WI
Adenomyosis	10	33.3	Continuous with uterine lesions
Decidualization	4	13.3	Found in pregnancy-related cases

Table 5: Outcomes of Treatment

Treatment Outcome	Cases (n)	Percentage (%)	Findings on MRI
Reduction in Lesion Size	20	66.7	Significant post-treatment improvement
No Change in Lesion Size	7	23.3	Observed in resistant cases
Recurrence of Lesions	3	10.0	Notable in cases with incomplete excision

these findings, highlighting the role of MRI in differentiating benign from malignant masses, particularly in atypical locations or morphologies.

Lesion distribution varied, with ovarian involvement (73.3%) being the most common, followed by rectosigmoid (26.7%), diaphragm (10%), and abdominal wall (6.7%). These observations are consistent with the findings of Abrao *et al*.[14] (2007), who documented similar frequencies of bowel and extrapelvic involvement in cases of severe endometriosis.

Interestingly, patients with bowel involvement in our study exhibited the “mushroom cap sign” on MRI, previously described by Yoon *et al*.[5] (2010) as a reliable imaging feature of rectosigmoid endometriosis. This sign helped differentiate endometriotic nodules from other rectal wall abnormalities and was seen in 26.7% of our cases.

Fibrotic nodules and hemorrhagic foci were the most common histological findings in our study, seen in 60% and 40% of cases, respectively. These histopathologic patterns closely correlated with the T2 hypointense and T1 hyperintense MRI features, confirming the reliability of MRI in predicting lesion composition. Similar conclusions were drawn by Foti et al.[15] (2018), who noted that MRI accurately reflects hemorrhagic content and fibrotic transformation in endometriotic tissue.

Decidualization, seen in 13.3% of our cases (particularly those associated with pregnancy), presented as rapidly enlarging lesions on MRI. This aligns with findings by Maggiore *et al*.[16] (2008), who highlighted decidual changes as a pregnancy-related complication of endometriosis that may mimic malignancy.

Post-treatment imaging showed lesion size reduction in 66.7% of patients, no change in 23.3%, and recurrence in 10%. These outcomes are comparable to those reported by Zakhari *et al*.[17] (2020), who found that hormonal and surgical treatment significantly reduced lesion burden in the majority of patients, but recurrence remained a concern in cases with incomplete resection or inadequate follow-up.

Our data underscore MRI's role not just in diagnosis but also in monitoring treatment response and identifying recurrence, particularly in high-risk or complex cases.

CONCLUSION

The study demonstrates that MRI effectively detects key features such as T2-shading, T2 dark spot signs, and deeply infiltrating endometriosis, contributing to early diagnosis and informed clinical management. Additionally, it highlights MRI's utility in uncovering extrapelvic and polypoid manifestations, which are frequently missed by conventional techniques. These findings emphasize the need for integrating advanced MRI protocols into routine diagnostic frameworks to better address the challenges of rare endometriotic presentations. Future research should focus on enhancing diagnostic algorithms and exploring the role of emerging imaging techniques to further optimize patient outcomes.

REFERENCES

1. Endometriosis . https://www.who.int/news-room/fact-sheets/detail/endometriosis
2. J. Lamceva, Uljanovs .R, Strumfa .I. The Main Theories on the Pathogenesis of Endometriosis. Int. J. Mol. Sci., 2023, 24:4254.
3. P. Parasar, Ozcan .P, Terry .K.L. Endometriosis: Epidemiology, Diagnosis and Clinical Management. Curr. Obstet. Gynecol. Rep., 2017, 6:34-41.
4. P. Vercellini, Viganò .P, Somigliana .E, Fedele .L. Endometriosis: Pathogenesis and Treatment. Nat Rev Endocrinol 2014, 10: 261-275.
5. J.H. Yoon, Choi .D, Jang .K.T, Kim .C.K, Kim .H, Lee .S.J, *et al*. Deep rectosigmoid endometriosis: “mushroom cap” sign on T2-weighted MR imaging. Abdom Imaging 2010, 35:726–731.
6. Lupean .R.A, Stefan PA, Csutak C, Lebovici A, Malutan AM, Buiga R, *et al*. Differentiation of Endometriomas from Ovarian Hemorrhagic Cysts at Magnetic Resonance: The Role of Texture Analysis. Medicina (Mex) 2020, 56:487.

7. Korean Journal of Radiology. https://kjronline.org/DOIx.php?id=10.3348/kjr.2021.0405
8. M. Takeuchi, Matsuzaki .K, Bando .Y, Harada .M. Magnetic resonance imaging characteristics of polypoid endometriosis and review of the literature. J. Obstet. Gynaecol. Res., 2022, 48:2583–2593.
9. Y.O. Tanaka, Yoshizako T, Nishida M, Yamaguchi M, Sugimura K, Itai Y. Ovarian carcinoma in patients with endometriosis: MR imaging findings. AJR Am J Roentgenol 2000, 175:1423–1430.
10. M. Bazot, Darai .E, Hourani .R, Thomassin I, Cortez A, Uzan S, et al. Deep pelvic endometriosis: MR imaging for diagnosis and prediction of extension of disease. Radiology 2004, 232:379-489.
11. Thomassin-Naggara I, Daraï E, Cuenod CA, Rouzier R, Callard P, Bazot M. Dynamic contrast-enhanced magnetic resonance imaging: a useful tool for characterizing ovarian epithelial tumors. J Magn Reson Imaging JMRI 2008, 28:111-120.
12. Alifano M, Trisolini R, Cancellieri A, Regnard JF. Thoracic endometriosis: current knowledge. Ann Thorac Surg 2006, 81:761-769.
13. Parker RL, Dadmanesh F, Young RH, Clement PB. Polypoid endometriosis: a clinicopathologic analysis of 24 cases and a review of the literature. Am J Surg Pathol 2004, 28:285–297.
14. eep endometriosis infiltrating the recto-sigmoid: Critical factors to consider before management. ResearchGate https://www.researchgate.net/publication/271534016_Deep_endometriosis_infiltrating_the_recto-sigmoid_Critical_factors_to_consider_before_management
15. Foti PV, Farina R, Palmucci S, Vizzini IAA, Libertini N, Coronella M, et al. Endometriosis: clinical features, MR imaging findings and pathologic correlation. Insights Imaging 2018, 9:149-172.
16. Leone Roberti Maggiore U, Ferrero S, Mangili G, Bergamini A, Inversetti A, Giorgione V, et al. A systematic review on endometriosis during pregnancy: diagnosis, misdiagnosis, complications and outcomes. Hum Reprod Update 2016, 22: 70–103.
17. Zakhari A, Delpero E, McKeown S, Tomlinson G, Bougie O, Murji A. Endometriosis recurrence following post-operative hormonal suppression: a systematic review and meta-analysis. Hum Reprod Update 2020, 27: 96–107.