



Diagnostic Utility of MRI in Deeply Infiltrating Endometriosis: A Hospital-Based Study

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KEYWORDS

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ABSTRACT:

Background: Deeply infiltrating endometriosis (DIE) is a severe form of endometriosis associated with chronic pelvic pain, infertility and reduced quality of life. Early and accurate diagnosis is essential for effective management and surgical planning. While laparoscopy remains the gold standard, magnetic resonance imaging (MRI) offers a non-invasive alternative with the potential to improve preoperative assessment.

Methods: This hospital-based cross-sectional study was conducted in the Department of Obstetrics and Gynecology, Bangladesh Medical University (BMU), in collaboration with Ibn Sina Diagnostic and Imaging Center, Dhaka, from June 2024 to July 2025. A total of 98 women with suspected DIE were consecutively enrolled. All participants underwent pelvic MRI followed by laparoscopy with or without histopathological confirmation. Demographic data, clinical symptoms, MRI findings and surgical outcomes were recorded. Statistical analysis was performed using SPSS version 25 to assess the diagnostic accuracy of MRI compared with laparoscopy.

Results: The majority of women were aged 25–34 years (39.8%) and presented most frequently with chronic pelvic pain (41.8%). MRI revealed uterosacral ligament involvement in 37.8%, rectovaginal septum in 26.5% and rectosigmoid colon in 21.4%. Laparoscopic confirmation showed similar trends, with multiple-site involvement in 32.7% of cases. MRI demonstrated high diagnostic accuracy, with sensitivity ranging from 79.3% to 85.7% and specificity from 94.8% to 97.8% across different anatomical sites. The overall sensitivity and specificity of MRI for DIE detection were 89.2% and 94.5%, respectively.

Conclusion: MRI is a highly sensitive and specific, non-invasive diagnostic tool for detecting DIE, making it valuable for preoperative evaluation and surgical planning in Bangladeshi women.



Introduction

Endometriosis is a chronic gynecological condition characterized by the presence of endometrial glands and stroma outside the uterine cavity, most commonly affecting women of reproductive age. It is estimated to affect 10–15% of women in this group and up to 30–50% of women presenting with infertility or chronic pelvic pain [1, 2]. Deeply infiltrating endometriosis (DIE) represents the most severe form of the disease, defined as lesions infiltrating more than 5 mm beneath the peritoneal surface [3]. These lesions often involve the uterosacral ligaments, rectovaginal septum, bowel, bladder and occasionally the vaginal wall, resulting in debilitating symptoms such as dysmenorrhea, dyspareunia, dyschezia and infertility [4].

The diagnosis of DIE remains a clinical challenge. Clinical examination has limited sensitivity, particularly for deep or multifocal lesions and many cases remain undetected until advanced stages. Transvaginal ultrasound (TVUS) is widely available and inexpensive and while it is useful for detecting ovarian endometriomas, its accuracy for assessing deep pelvic lesions depends heavily on operator expertise [5]. Laparoscopy with histopathological confirmation remains the gold standard for diagnosis, but it is invasive, costly and not suitable as a primary diagnostic tool for all patients [6]. Therefore, there is a strong need for a reliable, non-invasive and widely applicable imaging modality to identify and map DIE before surgery [7].

Magnetic resonance imaging (MRI) has emerged as a valuable tool in the preoperative evaluation of suspected DIE. It provides multiplanar high-resolution images with excellent soft-tissue contrast, allowing detailed assessment of lesion location, extent and relation to surrounding organs [8]. MRI is particularly advantageous for detecting posterior compartment disease, rectovaginal septum involvement, bladder lesions and bowel infiltration [9]. Several international studies have reported high sensitivity and specificity of MRI for DIE, ranging from 80–90%, making it an increasingly recommended modality for surgical planning [10]. By accurately mapping the disease, MRI helps gynecologic surgeons anticipate complex procedures, counsel patients about fertility and surgical risks and improve multidisciplinary collaboration when bowel or urological involvement is suspected [11].

The present study was designed to assess the diagnostic utility of MRI in detecting deeply infiltrating endometriosis in Bangladeshi women with suspected disease. By comparing MRI findings with laparoscopic and histopathological confirmation, we aimed to

determine its sensitivity, specificity and overall accuracy.

Methodology & Materials

This hospital-based cross-sectional study was conducted in the Department of Obstetrics and Gynecology, Bangladesh Medical University (BMU), in collaboration with the Ibn Sina Diagnostic and Imaging Center, Dhanmondi, Dhaka, from June 2024 to July 2025. A total of 98 women with suspected deeply infiltrating endometriosis (DIE) were enrolled consecutively during the study period. Inclusion criteria were women of reproductive age presenting with clinical suspicion of DIE based on symptoms such as chronic pelvic pain, dysmenorrhea, dyspareunia, or infertility, who underwent both pelvic MRI and subsequent laparoscopy with or without histopathological confirmation. Exclusion criteria included women with previous pelvic malignancy, those with contraindications to MRI such as metallic implants or severe claustrophobia, those with incomplete imaging or operative data and pregnant women.

Magnetic resonance imaging was performed using a 1.5 Tesla scanner with standard pelvic endometriosis protocol, including sagittal, axial and oblique T2-weighted sequences, T1-weighted and T1 fat-suppressed images. Antispasmodic agents were used when feasible to reduce bowel peristalsis. MRI images were independently reviewed by two experienced radiologists who were blinded to laparoscopic findings. The presence, location and extent of DIE lesions were documented, with particular attention to the uterosacral ligaments, rectovaginal septum, rectosigmoid colon, bladder, vaginal wall and associated ovarian endometriomas. Laparoscopic findings with or without histopathological confirmation served as the reference standard.

Data were collected using a structured case record form and entered into SPSS version 25. Descriptive statistics were expressed as frequencies and percentages for categorical variables and mean \pm standard deviation for continuous variables. Diagnostic performance of MRI was assessed using sensitivity, specificity, positive predictive value and negative predictive value with 95% confidence intervals, calculated overall and for each anatomical site. Interobserver agreement between the two radiologists was evaluated using Cohen's kappa statistics. A p-value of less than 0.05 was considered statistically significant.



Results

Table 1: Baseline Characteristics of the Study Participants (n = 98)

Characteristics	n	%
Age group (years)		
• <25	11	11.20%
• 25–34	39	39.80%
• 35–44	33	33.70%
• ≥45	15	15.30%
Parity		
• Nulliparous	46	46.90%
• Multiparous	52	53.10%
Main presenting symptom		
• Chronic pelvic pain	41	41.80%
• Dysmenorrhea	23	23.50%
• Dyspareunia	13	13.30%
• Infertility	17	17.30%
• Others	4	4.10%

Table 1 presents the baseline characteristics of the study participants (n = 98). The majority of patients were within the age group of 25–34 years (39.8%), followed by 35–44 years (33.7%), while 15.3% were aged ≥45 years and 11.2% were younger than 25 years. Regarding parity, slightly more than half of the participants were multiparous (53.1%), while 46.9% were nulliparous. The most common presenting symptom was chronic pelvic pain (41.8%), followed by dysmenorrhea (23.5%), infertility (17.3%) and dyspareunia (13.3%), whereas a smaller proportion (4.1%) reported other symptoms.

Table 2: Distribution of MRI Findings by Anatomical Site (n = 98)

Site of DIE lesion	n	%
Uterosacral ligament	37	37.80%
Rectovaginal septum	26	26.50%
Rectosigmoid colon	21	21.40%
Bladder	9	9.20%

Table 4: Diagnostic Accuracy of MRI for DIE Compared with Laparoscopy (n = 98)

Site of lesion	True Positive (n, %)	False Positive (n, %)	True Negative (n, %)	False Negative (n, %)	Sensitivity (%)	Specificity (%)
Uterosacral ligament	35	2 (2.0%)	53	8 (8.2%)	81.4	96.4

Vaginal wall	6	6.10%
Ovarian endometrioma (assoc)	19	19.40%
Multiple sites	28	28.60%

Table 2 shows the distribution of MRI-detected deeply infiltrating endometriosis (DIE) lesions by anatomical site. The uterosacral ligaments were the most frequently involved site, observed in 37.8% of patients, followed by the rectovaginal septum in 26.5% and the rectosigmoid colon in 21.4%. Bladder and vaginal wall involvement were less common, seen in 9.2% and 6.1% of participants, respectively. Associated ovarian endometriomas were detected in 19.4% of cases and multiple-site involvement was noted in 28.6% of patients, highlighting the multifocal nature of the disease in a significant proportion of the study population.

Table 3: Laparoscopic/Histopathological Findings (n = 98)

Site confirmed by surgery	n	%
Uterosacral ligament	41	41.80%
Rectovaginal septum	29	29.60%
Rectosigmoid colon	18	18.40%
Bladder	7	7.10%
Vaginal wall	5	5.10%
Ovarian endometrioma (assoc)	22	22.40%
Multiple sites	32	32.70%

Table 3 summarizes the laparoscopic and histopathological findings of deeply infiltrating endometriosis (DIE) in the study participants. The uterosacral ligaments were the most commonly involved site, confirmed in 41.8% of patients, followed by the rectovaginal septum in 29.6% and the rectosigmoid colon in 18.4%. Bladder and vaginal wall involvement were less frequent, observed in 7.1% and 5.1% of cases, respectively. Associated ovarian endometriomas were detected in 22.4% of patients. Multiple-site involvement was noted in 32.7% of participants, reflecting the complex and multifocal nature of DIE in this cohort.



	(35.7%)		(54.1%)			
Rectovaginal septum	23 (23.5%)	3 (3.1%)	66 (67.3%)	6 (6.1%)	79.3	95.6
Rectosigmoid colon	17 (17.3%)	4 (4.1%)	73 (74.5%)	4 (4.1%)	81	94.8
Bladder	6 (6.1%)	3 (3.1%)	88 (89.8%)	1 (1.0%)	85.7	96.7
Vaginal wall	4 (4.1%)	2 (2.0%)	91 (92.9%)	1 (1.0%)	80	97.8
Overall DIE detection	83 (84.7%)	5 (5.1%)	86 (87.8%)	10 (10.2%)	89.2	94.5

Table 4 presents the diagnostic accuracy of MRI for detecting deeply infiltrating endometriosis (DIE) compared with laparoscopic and histopathological findings. For the uterosacral ligaments, MRI correctly identified 35 patients (35.7%) as true positive, with 2 false positives and 8 false negatives, resulting in a sensitivity of 81.4% and specificity of 96.4%. In the rectovaginal septum, MRI showed 23 true positives, 3 false positives and 6 false negatives, yielding a sensitivity of 79.3% and specificity of 95.6%. For rectosigmoid colon lesions, 17 true positives and 4 false positives were observed, with a sensitivity of 81.0% and specificity of 94.8%. Bladder involvement was detected with 85.7% sensitivity and 96.7% specificity, while vaginal wall lesions showed 80% sensitivity and 97.8% specificity. Overall, MRI demonstrated high diagnostic performance in detecting DIE, with 83 true positives and 5 false positives across all sites, corresponding to an overall sensitivity of 89.2% and specificity of 94.5%, confirming its value as a reliable non-invasive imaging modality for preoperative assessment.

Discussion

This hospital-based study evaluated the diagnostic utility of magnetic resonance imaging (MRI) in detecting deeply infiltrating endometriosis (DIE) compared with laparoscopic and histopathological confirmation. The findings demonstrated that MRI has high sensitivity and specificity across different anatomical sites, confirming its value as a reliable, non-invasive diagnostic tool in Bangladeshi women with suspected DIE.

The baseline characteristics of the study population are consistent with previous epidemiological reports, where endometriosis predominantly affects women of reproductive age. Cardoso et al., described a similar age distribution, highlighting that the majority of women present between their late 20s and 40s, often with infertility or chronic pelvic pain as the main complaints [12]. Our cohort also reflected these patterns, with chronic pelvic pain being the most common presenting

symptom, followed by dysmenorrhea and infertility. These findings align with the observations of Ballard et al., who emphasized the strong association between symptomatology and the likelihood of underlying endometriosis [13].

The multifocal nature of DIE in our study, with uterosacral ligaments and rectovaginal septum being the most commonly affected sites, is in agreement with the work of Parasar et al., who identified these anatomical regions as frequent sites of involvement [14]. The recognition of multifocal lesions is important for surgical planning, as incomplete resection of deep nodules can result in persistent symptoms and recurrence. Imboden et al., also highlighted the need for comprehensive assessment, given that patients often require multimodal treatment tailored to the distribution of lesions [15].

MRI demonstrated excellent diagnostic performance in our study, with overall sensitivity of 89.2% and specificity of 94.5%. This high diagnostic accuracy is comparable to findings from Burghaus et al., who emphasized MRI as a standard imaging modality in specialized endometriosis centers, particularly for detecting rectovaginal and bowel involvement [16]. Similarly, Szyllit et al., reported that MRI provided reliable detection of DIE in women of reproductive age, reinforcing its utility as a first-line imaging technique [17]. The strength of MRI lies in its ability to identify both single and multiple-site involvement, which was observed in nearly one-third of our cases.

Although laparoscopy remains the gold standard for diagnosis, our findings support the growing evidence that MRI can substantially reduce the diagnostic delay associated with endometriosis. Al Shukri et al., reported that early recognition of clinical features combined with imaging improves timely diagnosis [18]. This is critical, as delays often lead to disease progression and increased morbidity. Furthermore, Vercellini et al. advocated for reducing low-value interventions and



emphasized the importance of accurate imaging in preventing unnecessary procedures [19].

The relationship between DIE and other gynecological disorders, particularly adenomyosis, has been a topic of debate. Habiba et al., suggested that adenomyosis and endometriosis may represent phenotypes of a common disease process [20]. This perspective underscores the value of MRI, which can simultaneously evaluate adenomyotic changes and deep infiltrating lesions, thereby contributing to more comprehensive patient management. In addition, unusual sites of DIE, such as bladder or extrapelvic involvement, though less common in our study, have been highlighted in case reports such as Zhao et al., where rare localization can pose diagnostic challenges [21].

From a broader perspective, Upson emphasized the potential influence of environmental and lifestyle factors on the pathogenesis of endometriosis [22]. While our study was not designed to assess risk factors, the epidemiological context in Bangladesh may reflect environmental contributions, warranting further investigation. Establishing specialized diagnostic centers, as reported by Ebert et al., in German-speaking Europe, has proven effective in standardizing care and improving outcomes [23]. Similar structured approaches could be beneficial in resource-limited settings like ours.

Limitations of the study

This study has certain limitations that should be acknowledged. It was conducted in only two centers, which may limit the generalizability of the findings to broader populations. In addition, the relatively small sample size of 98 participants may have reduced the statistical power to detect less common patterns of deeply infiltrating endometriosis. Future multicenter studies with larger cohorts are needed to validate and strengthen these findings.

Conclusion

Overall, our findings confirm that MRI is a highly accurate, non-invasive diagnostic modality for DIE, capable of detecting lesions with high sensitivity and specificity. This is particularly important for surgical planning, patient counseling and reducing the reliance on invasive procedures for initial diagnosis. The integration of MRI into diagnostic pathways, combined with careful clinical evaluation, has the potential to improve early detection, optimize treatment and ultimately enhance quality of life for affected women.

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Conflicts of interest

There are no conflicts of interest.

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