



## A Comparative Study of the Accuracy of Transvaginal Ultrasound (TVUS) versus Magnetic Resonance Imaging (MRI) in the Characterization of Uterine Adenomyosis

Dr Ketki Naik<sup>1</sup>, Dr Asmita Suryawanshi<sup>2</sup>, Dr Devidas Dahiphale<sup>3</sup>

<sup>1</sup>JR3 Resident, Department of Radiology, MGM Medical College Chh. Sambhajinagar, India.

<sup>2</sup>Associate Professor, Department of Radiology, MGM Medical College Chh. Sambhajinagar, India.

<sup>3</sup>Professor and HOD, Department of Radiodiagnosis, MGM Medical College Chh. Sambhajinagar, India.



**Correspondence:**  
Dr. Ketki Naik

**Received:** January 05, 2026

**Revised:** February 20, 2026

**Accepted:** March 13, 2026

**Published:** March 16, 2026

### Abstract

**Background:** Adenomyosis is a benign gynecological disorder characterized by the ectopic presence of endometrial glands and stroma within the myometrium, often leading to dysmenorrhea, menorrhagia, and infertility. Accurate diagnosis is essential for optimal patient management. While histopathology remains the gold standard, non-invasive imaging modalities—particularly transvaginal ultrasound (TVUS) and magnetic resonance imaging (MRI)—play crucial roles in preoperative diagnosis. **Objectives:** This study aimed to compare the diagnostic accuracy of TVUS and MRI in characterizing uterine adenomyosis, using histopathological findings as the reference standard. **Methods:** A prospective observational study was conducted at MGM Medical College and Hospital, Chhatrapati Sambhaji Nagar, Maharashtra, involving 68 women aged 25–55 years with clinical suspicion of adenomyosis. All participants underwent both TVUS and MRI prior to surgery. Imaging findings were compared with histopathological results for diagnostic accuracy assessment. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy were calculated. **Results:** Of the 68 cases, histopathology confirmed adenomyosis in 44 (64.7%) patients. TVUS demonstrated a sensitivity of 81.8%, specificity of 75%, PPV of 85%, NPV of 69.2%, and accuracy of 79.4%. MRI showed a higher sensitivity (93.2%), specificity (87.5%), PPV (91.3%), NPV (89.7%), and overall accuracy of 91.2%. MRI was superior in detecting diffuse adenomyosis and concomitant uterine pathologies such as fibroids. **Conclusion:** MRI provides superior diagnostic accuracy compared to TVUS in characterizing uterine adenomyosis, particularly in differentiating it from other myometrial abnormalities. However, TVUS remains a valuable first-line, cost-effective, and accessible tool. Integrating both modalities can enhance diagnostic confidence and improve patient outcomes.

**Keywords:** Adenomyosis, Transvaginal ultrasound, Magnetic resonance imaging, Diagnostic accuracy, Uterine pathology



This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).

### INTRODUCTION

Adenomyosis is a chronic benign uterine disorder characterized by the ectopic proliferation of endometrial glands and stroma within the myometrium, leading to uterine enlargement and associated clinical symptoms such as dysmenorrhea, menorrhagia, and chronic pelvic pain. Moawad G et al. (2023)<sup>1</sup> It often affects women in the reproductive age range, especially those between the ages of 35 and 50, and is frequently linked to infertility and unfavourable reproductive outcomes. Wong S et al. (2022)<sup>2</sup>

Non-invasive imaging is essential for the diagnosis and treatment of adenomyosis, despite the fact that it is characterised histopathologically. Ectopic endometrial tissue within the myometrium at least 2.5 mm from the endometrial–myometrial junction confirms the typical diagnosis following hysterectomy. Hussain S et al.

(2022)<sup>3</sup> However, imaging methods including transvaginal ultrasound (TVUS) and magnetic resonance imaging (MRI) have become essential in assessing suspected instances due to the invasiveness of surgical diagnosis. Celli V et al. (2022)<sup>4</sup>

Because histological evidence is required, it is challenging to ascertain the precise prevalence of adenomyosis. According to studies, 20–35% of hysterectomy specimens had it. Upson K et al. (2020)<sup>5</sup> Clinically, adenomyosis causes excessive monthly bleeding, severe dysmenorrhea, dyspareunia, and infertility, all of which considerably increase morbidity. The illness may manifest as localised or generalised adenomyosis (adenomyoma). It's critical to distinguish adenomyosis from other uterine conditions such

**Citation:** Naik K, Suryawanshi A, Dahiphale D A Comparative Study of the Accuracy of Transvaginal Ultrasound (TVUS) versus Magnetic Resonance Imaging (MRI) in the Characterization of Uterine Adenomyosis. *Int. J. Med.*, 2026;8(3):193-199.

leiomyomas or endometrial diseases since their treatment approaches are very different. Struble J et al. (2016)<sup>6</sup>

Due to its accessibility, affordability, and non-invasiveness, TVUS is frequently utilised as the first-line imaging method. Myometrial cysts, loss of the endometrial–myometrial junctional zone, asymmetrical thickening of the uterine walls, and a heterogeneous myometrial echotexture are typical sonographic characteristics. Daniilidis A et al. (2022)<sup>7</sup> However, MRI offers better spatial resolution and soft-tissue contrast, enabling a thorough evaluation of the uterine architecture, including the junctional zone. Adenomyosis is characterised by thickening of the junctional zone (>12 mm) on MRI; low-signal intensity regions on T2-weighted images indicate hypertrophied myometrium and ectopic endometrial tissue. Bruno F et al. (2019)<sup>8</sup>

There is still variation in the stated sensitivity and specificity of TVUS and MRI, despite the fact that both have shown diagnostic efficacy. In skilled hands, TVUS provides exceptional diagnostic accuracy while being very operator-dependent. Although MRI is less operator-dependent, it is more costly and less widely available, particularly in environments with limited resources. Bruno F et al. (2019)<sup>8</sup> Determining their relative accuracy and function in the adenomyosis diagnostic method is therefore clinically important.

The diagnostic accuracy of various modalities has been found to vary in recent research. MRI sensitivity and specificity were found by Chung YJ et al. (2023)<sup>9</sup> to be 88% and 93%, respectively, whereas TVUS sensitivity and specificity were 80% and 74%. In a similar vein, Andres MP et al. (2018)<sup>10</sup> stressed the significance of MRI in assessing adenomyosis, particularly when coexisting fibroids obfuscate the myometrial architecture or when ultrasound results are equivocal. Determining the relative diagnostic performance of TVUS and MRI can aid in the creation of economical diagnostic paths in India, where the distribution of healthcare resources is a significant challenge. TVUS may continue to be the preferred screening method for the majority of patients, even when MRI may be used as a confirming modality. Bruno F et al. (2019)<sup>8</sup>

Adenomyosis is a complex aetiology that includes inflammatory, hormonal, and mechanical processes. According to the "tissue injury and repair" theory, endometrial invasion may be facilitated by repetitive uterine peristalsis and mechanical strain that disturb the endometrial–myometrial contact. Myometrial hypertrophy is further encouraged by oestrogen dependence and changed local cytokine milieu. Zhai J et al. (2020)<sup>11</sup> The imaging symptoms seen on TVUS and MRI are influenced by these pathophysiologic characteristics. This study attempts to systematically assess the diagnostic accuracy of TVUS and MRI versus histopathological results in women with clinically

suspected adenomyosis, given the clinical burden of adenomyosis and the diversity in imaging findings.

### Objectives:

1. To evaluate and compare the diagnostic sensitivity, specificity, and accuracy of TVUS and MRI in detecting uterine adenomyosis.
2. To correlate imaging findings with histopathological diagnosis.
3. To assess the ability of each imaging modality to differentiate focal and diffuse adenomyosis and identify associated uterine pathologies.

The results of this comparative study may guide clinicians in choosing the most appropriate diagnostic strategy, thereby optimizing patient management and reducing unnecessary investigations.

## MATERIALS AND METHODS

### Study Design

This was a prospective observational comparative study conducted at the Department of Radiology and Obstetrics & Gynecology, MGM Medical College and Hospital, Chhatrapati Sambhaji Nagar, Maharashtra.

### Study Duration

January 2023 to October 2024.

### Sample Size

68 women with clinical suspicion of adenomyosis.

### Inclusion Criteria

- Women aged 25–55 years presenting with dysmenorrhea, menorrhagia, or infertility.
- Clinically suspected adenomyosis on pelvic examination.
- Patients scheduled for hysterectomy or myomectomy with histopathological confirmation available.

### Exclusion Criteria

- Prior uterine surgery or endometrial ablation.
- Known uterine malignancy.
- Pregnancy.
- Inadequate imaging or incomplete data.

### Data Collection and Imaging Protocol

#### Transvaginal Ultrasound (TVUS)

Performed using high-frequency (5–9 MHz) transducers. Features assessed included:

- Myometrial heterogeneity
- Asymmetrical wall thickening
- Myometrial cysts
- Hyperechoic islands
- Linear striations extending from the endometrium
- Poorly defined endometrial–myometrial junction

A diagnosis of adenomyosis was made if at least three criteria were present.

**Citation:** Naik K, Suryawanshi A, Dahiphale D A Comparative Study of the Accuracy of Transvaginal Ultrasound (TVUS) versus Magnetic Resonance Imaging (MRI) in the Characterization of Uterine Adenomyosis. *Int. J. Med.*, 2026;8(3):193-199.

### Magnetic Resonance Imaging (MRI)

MRI was performed using a 1.5-Tesla scanner with pelvic coil. Sequences included T1- and T2-weighted sagittal, axial, and coronal images. Key diagnostic criteria:

- Junctional zone thickness >12 mm
- Low-signal intensity areas within the junctional zone
- Small high-signal foci representing hemorrhagic spots
- Uterine enlargement without distinct fibroid borders

### Histopathology

Following hysterectomy/myomectomy, specimens were examined for ectopic endometrial glands and stroma within the myometrium. Histopathology was considered the gold standard.

### Statistical Analysis

Data were analyzed using SPSS version 25. Sensitivity, specificity, PPV, NPV, and diagnostic accuracy were calculated for both modalities using histopathology as reference. Chi-square tests were used for categorical variables. A p-value <0.05 was considered statistically significant.

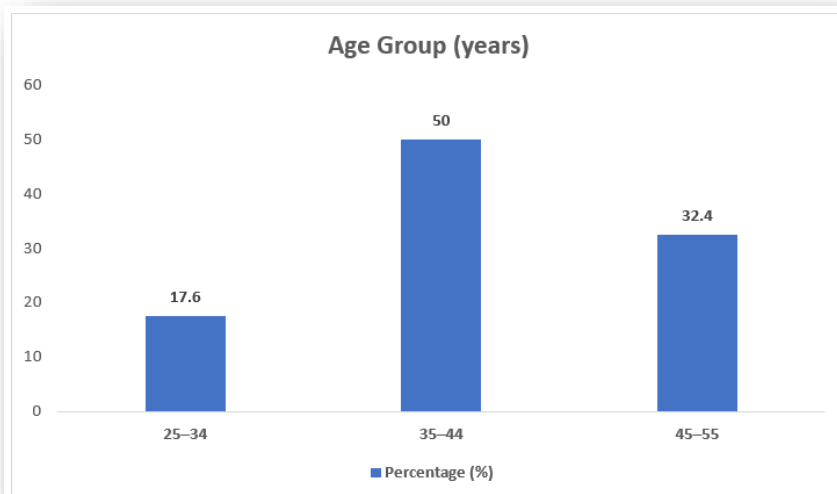
## RESULTS

**Table 1: Demographic Profile of Study Participants (n = 68)**

| Age Group (years) | Number of Patients | Percentage (%) |
|-------------------|--------------------|----------------|
| 25–34             | 12                 | 17.6           |
| 35–44             | 34                 | 50.0           |
| 45–55             | 22                 | 32.4           |
| <b>Total</b>      | <b>68</b>          | <b>100</b>     |

**Observation:** Majority (50%) of cases were between 35–44 years.

The age distribution of patients showed that the majority of participants, or 50% (n = 34) of the study population, were between the ages of 35 and 44. Only 12 patients (17.6%) were between the ages of 25 and 34, whereas 22 patients (32.4%) were in the 45–55 age range. The increased frequency of adenomyosis among women in their late reproductive years, which is frequently linked to extended oestrogen exposure and multiparity, is consistent with its preponderance in the 35–44 age group. The usual demographic profile of individuals with symptomatic adenomyosis is shown in this age-related trend.



**Figure 1: Demographic Profile of Study Participants**

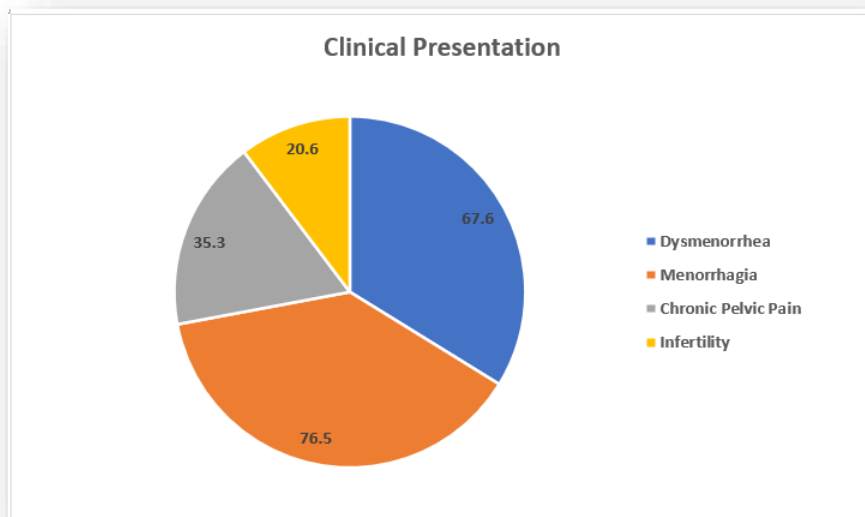
**Table 2: Clinical Presentation**

| Symptoms            | Number of Patients | Percentage (%) |
|---------------------|--------------------|----------------|
| Dysmenorrhea        | 46                 | 67.6           |
| Menorrhagia         | 52                 | 76.5           |
| Chronic Pelvic Pain | 24                 | 35.3           |
| Infertility         | 14                 | 20.6           |

**Observation:** Menorrhagia was the most common symptom (76.5%).

**Citation:** Naik K, Suryawanshi A, Dahiphale D A Comparative Study of the Accuracy of Transvaginal Ultrasound (TVUS) versus Magnetic Resonance Imaging (MRI) in the Characterization of Uterine Adenomyosis. *Int. J. Med.*, 2026;8(3):193-199.

Menorrhagia was the most often reported clinical characteristic, found in 52 individuals (76.5%), followed by dysmenorrhea in 46 patients (67.6%), according to the study of presenting symptoms. Fourteen patients (20.6%) experienced infertility, while twenty-four patients (35.3%) claimed chronic pelvic discomfort. These results suggest that the classic signs of adenomyosis include irregular uterine flow and monthly discomfort. The participants' older age distribution, where reproductive issues are less common than in younger cohorts, may be the reason for the comparatively lower prevalence of infertility. In general, the clinical presenting profile is consistent with the recognised adenomyosis symptomatology.



**Figure 2: Clinical Presentation**

**Table 3. Imaging Diagnosis vs Histopathology**

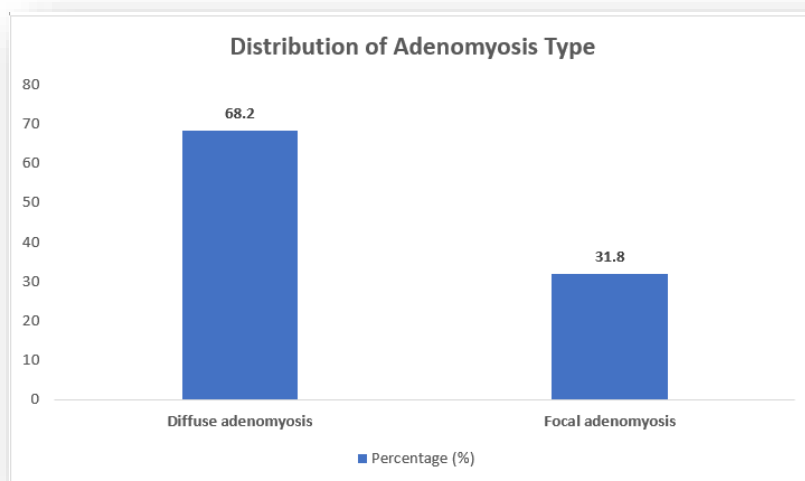
| Modality | True Positive | False Positive | True Negative | False Negative | Sensitivity (%) | Specificity (%) | Accuracy (%) |
|----------|---------------|----------------|---------------|----------------|-----------------|-----------------|--------------|
| TVUS     | 36            | 6              | 18            | 8              | 81.8            | 75.0            | 79.4         |
| MRI      | 41            | 3              | 21            | 3              | 93.2            | 87.5            | 91.2         |

This table compares the diagnostic performance of TVUS and MRI against histopathological results, which were the gold standard. With 36 true positives, 6 false positives, 18 true negatives, and 8 false negatives, TVUS had an overall accuracy of 79.4%, a sensitivity of 81.8%, and a specificity of 75.0%. With 41 true positives, 3 false positives, 21 true negatives, and 3 false negatives, MRI, on the other hand, showed better diagnostic accuracy, with sensitivity of 93.2%, specificity of 87.5%, and accuracy of 91.2%. These findings demonstrate that MRI is superior than TVUS in the diagnosis of adenomyosis, especially because of its improved soft tissue contrast and capacity to distinguish adenomyosis from concomitant conditions like fibroids.

**Table 4: Distribution of Adenomyosis Type (Histopathology)**

| Type                | Number of Cases | Percentage (%) |
|---------------------|-----------------|----------------|
| Diffuse adenomyosis | 30              | 68.2           |
| Focal adenomyosis   | 14              | 31.8           |

Adenomyosis was divided into diffuse and localised kinds by histopathological analysis. There were 30 instances (68.2%) of the diffuse type and 14 cases (31.8%) of the focused form. While focal adenomyosis, also called adenomyoma, manifests as localised nodular lesions, diffuse adenomyosis includes extensive infiltration of endometrial glands and stroma into the myometrium, frequently resulting in an enlarged, globular uterus. The diffuse variant's preponderance is consistent with the overall epidemiological trend seen in the literature, indicating that its wider uterine involvement may have a higher clinical impact.

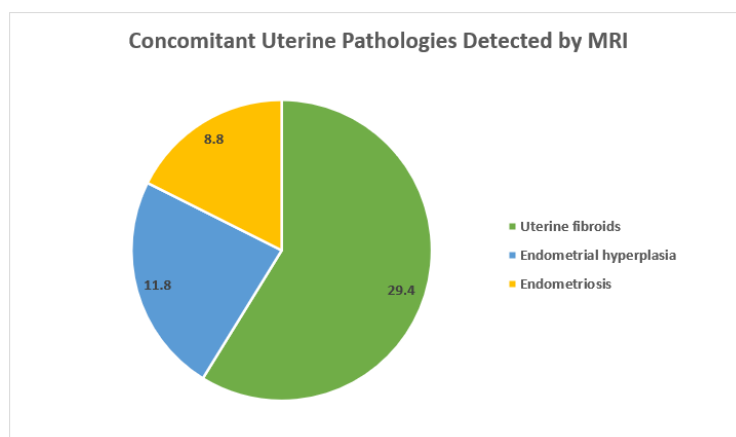


**Figure 3: Distribution of Adenomyosis Type (Histopathology)**

**Table 5: Concomitant Uterine Pathologies Detected by MRI**

| Pathology               | Number of Cases | Percentage (%) |
|-------------------------|-----------------|----------------|
| Uterine fibroids        | 20              | 29.4           |
| Endometrial hyperplasia | 8               | 11.8           |
| Endometriosis           | 6               | 8.8            |

The research participants' MRI assessment also showed a number of concomitant uterine abnormalities. The most common concomitant pathology, found in 20 instances (29.4%), was uterine fibroids. Eight patients (11.8%) had endometrial hyperplasia, while six cases (8.8%) had endometriosis. The clinical presentation and radiological interpretation of adenomyosis are frequently complicated by the presence of such concurrent disorders. The diagnostic benefit of MRI is highlighted by its capacity to identify these related disorders, enabling a more thorough assessment and supporting preoperative planning and management choices.



**Figure 4: Concomitant Uterine Pathologies Detected by MRI**

## DISCUSSION

This study compared the diagnostic accuracy of transvaginal ultrasound and magnetic resonance imaging in detecting uterine adenomyosis among 68 clinically suspected cases. Histopathology confirmed adenomyosis in 44 cases (64.7%). Our findings demonstrated that MRI exhibited higher sensitivity (93.2%) and specificity (87.5%) compared to TVUS (81.8% and 75%,

respectively), underscoring MRI's superior diagnostic reliability.

Comparison with earlier research Our study's findings on the diagnostic performance of both modalities are consistent with other research. The MRI sensitivity of 88% and specificity of 93% reported by Chung YJ et al. (2023)<sup>9</sup> were greater than the comparable TVUS values

**Citation:** Naik K, Suryawanshi A, Dahiphale D A Comparative Study of the Accuracy of Transvaginal Ultrasound (TVUS) versus Magnetic Resonance Imaging (MRI) in the Characterization of Uterine Adenomyosis. *Int. J. Med.*, 2026;8(3):193-199.

of 80% and 74%. Similarly, Andres MP et al. (2018)<sup>10</sup> and Agostinho L et al. (2017)<sup>12</sup> highlighted that MRI offers superior visualisation of the junctional zone, an important diagnostic characteristic that is not present on ultrasound. Our findings lend credence to the idea that MRI should only be used in situations when TVUS results are equivocal or when the myometrial architecture is obscured by other diseases such as fibroids. Bruno F et al. (2019)<sup>8</sup>

Because of its price, real-time imaging capacity, and accessibility, TVUS continues to be the preferred imaging modality. TVUS attained an accuracy of 79.4% in our investigation. Ultrasound performance is greatly influenced by operator experience. The most reliable sonographic characteristics were asymmetrical thickening, heterogeneous myometrial echotexture, and subendometrial echogenic linear striations. These results are in line with earlier findings by An XL et al. (2025)<sup>13</sup> and Atri M. et al. (2000)<sup>14</sup>.

Adenomyosis and leiomyoma may be accurately distinguished because of MRI's better soft-tissue contrast and multiplanar high-resolution imaging. In our sample, MRI accurately identified contemporaneous fibroids and endometriosis in 29.4% and 8.8% of cases, respectively, and accurately described diffuse adenomyosis in 68.2% of cases. These discoveries improve fertility control and surgical planning. Clinical ramifications For women who want to become pregnant, a precise preoperative diagnosis enables customised treatment, such as hormonal medication or uterine-sparing surgery. Hussain S et al. (2022)<sup>3</sup> Underdiagnosis worsens symptoms and delays therapy, whereas overdiagnosis may result in needless measures.

Both modalities' imaging results match histologic alterations such as endometrial gland infiltration, hemorrhagic foci, and myometrial hypertrophy. The severity of the illness is correlated with MRI junctional zone thickness (>12 mm). Our work highlights the diagnosis accuracy of MRI and the ongoing use of TVUS in low-resource settings by providing regional data from a tertiary care facility in Maharashtra. Even if MRI is better, in many clinical settings, patient tolerance, cost, and availability are constraints. Sequential employment of both modalities provides a balanced strategy that maximises diagnostic precision while guaranteeing cost-effectiveness. Foti PV et al. (2018)<sup>15</sup>

## CONCLUSION

MRI had better diagnostic accuracy than transvaginal ultrasound in identifying uterine adenomyosis, according to this comparative research of 68 women with clinically suspected adenomyosis. TVUS has sensitivity and specificity of 81.8% and 75%, respectively, compared to 93.2% and 87.5% for MRI. Diffuse adenomyosis and coexisting uterine anomalies, which are sometimes overlooked or misconstrued on ultrasonography, were

particularly well-identified by MRI. However, TVUS's affordability, accessibility, and real-time imaging capabilities make it an indispensable first diagnostic tool. TVUS can offer adequate diagnostic confidence for clinical management when used by skilled practitioners, particularly in settings with limited resources.

According to our results, MRI should only be used in instances that are unclear or when surgery is being considered. Combining the two modalities can improve patient outcomes, increase diagnostic confidence, and direct the right course of treatment. The study emphasises how crucial it is to create region-specific diagnostic algorithms that strike a compromise between precision and resource use. TVUS and MRI diagnostic performance may be improved with more extensive research including cutting-edge ultrasound methods like elastography and 3D ultrasound. In conclusion, transvaginal ultrasonography is still an essential first-line modality in gynaecologic imaging, even if MRI is still the gold standard for non-invasive characterisation of adenomyosis.

## LIMITATIONS OF THE STUDY

It is important to recognise the limitations of this study. First off, a single-center research with a rather modest sample size ( $n = 68$ ) was carried out. Because patient demographics and institutional policies may differ between centres, this small sample size may limit the findings' applicability to a larger population. Second, operator dependence in transvaginal ultrasound (TVUS) interpretation affects the study's conclusions. The sonologist's expertise and experience have a significant impact on TVUS accuracy, which may lead to variations in diagnostic performance. To reduce this impact, however, every test was carried out by skilled operators.

The absence of an assessment of inter-observer variability is another drawback. A formal assessment of agreement between various radiologists and sonologists was not included in the study. The capacity to evaluate the consistency and dependability of imaging interpretations among several observers is hampered by this absence.

Furthermore, a 1.5-Tesla scanner was used for all magnetic resonance imaging (MRI) tests. Higher-field scanners, such as 3-Tesla MRI, may offer better spatial resolution and tissue contrast, which might improve the identification and characterisation of small lesions, even though this field strength is often employed and clinically sufficient. Lastly, selection bias may have been introduced because histopathological correlation was only available for surgical patients. The absence of histological confirmation in patients who did not have surgery might have an impact on the study of overall diagnosis accuracy. The results of the study should thus be viewed cautiously, and more multicenter research

**Citation:** Naik K, Suryawanshi A, Dahiphale D A Comparative Study of the Accuracy of Transvaginal Ultrasound (TVUS) versus Magnetic Resonance Imaging (MRI) in the Characterization of Uterine Adenomyosis. *Int. J. Med.*, 2026;8(3):193-199.

with bigger cohorts and consistent histopathological correlation is advised to confirm these findings.

## REFERENCES

- Moawad G, Fruscalzo A, Youssef Y, Kheil M, Tawil T, Nehme J, Pirtea P, Guani B, Afaneh H, Ayoubi JM, Feki A. Adenomyosis: An Updated Review on Diagnosis and Classification. *J Clin Med.* 2023 Jul 21;12(14):4828. doi: 10.3390/jcm12144828. PMID: 37510943; PMCID: PMC10381628.
- Wong S, Ray CE Jr. Adenomyosis - An Overview. *Semin Intervent Radiol.* 2022 Feb 18;39(1):119-122. doi: 10.1055/s-0042-1742345. PMID: 35210742; PMCID: PMC8856779.
- Hussain S, Mubeen I, Ullah N, Shah SSUD, Khan BA, Zahoor M, Ullah R, Khan FA, Sultan MA. Modern Diagnostic Imaging Technique Applications and Risk Factors in the Medical Field: A Review. *Biomed Res Int.* 2022 Jun 6;2022:5164970. doi: 10.1155/2022/5164970. PMID: 35707373; PMCID: PMC9192206.
- Celli V, Dolciami M, Ninkova R, Ercolani G, Rizzo S, Porpora MG, Catalano C, Manganaro L. MRI and Adenomyosis: What Can Radiologists Evaluate? *Int J Environ Res Public Health.* 2022 May 11;19(10):5840. doi: 10.3390/ijerph19105840. PMID: 35627376; PMCID: PMC9140978.
- Upton K, Missmer SA. Epidemiology of Adenomyosis. *Semin Reprod Med.* 2020 May;38(2-03):89-107. doi: 10.1055/s-0040-1718920. Epub 2020 Oct 26. PMID: 33105509; PMCID: PMC7927213.
- Struble J, Reid S, Bedaiwy MA. Adenomyosis: A Clinical Review of a Challenging Gynecologic Condition. *J Minim Invasive Gynecol.* 2016 Feb 1;23(2):164-85. doi: 10.1016/j.jmig.2015.09.018. Epub 2015 Sep 30. PMID: 26427702.
- Daniilidis A, Grigoriadis G, Dalakoura D, D'Alterio MN, Angioni S, Roman H. Transvaginal Ultrasound in the Diagnosis and Assessment of Endometriosis- An Overview: How, Why, and When. *Diagnostics (Basel).* 2022 Nov 23;12(12):2912. doi: 10.3390/diagnostics12122912. PMID: 36552919; PMCID: PMC9777206.
- Bruno F, Arrigoni F, Mariani S, Splendiani A, Di Cesare E, Masciocchi C, Barile A. Advanced magnetic resonance imaging (MRI) of soft tissue tumors: techniques and applications. *Radiol Med.* 2019 Apr;124(4):243-252. doi: 10.1007/s11547-019-01035-7. Epub 2019 Apr 4. PMID: 30949892.
- Chung YJ, Rha SE, Kim MR, Shin YR. Correlation between MRI Features of Adenomyosis and Clinical Presentation. *Diagnostics (Basel).* 2023 Aug 24;13(17):2749. doi: 10.3390/diagnostics13172749. PMID: 37685287; PMCID: PMC10486376.
- Andres MP, Borrelli GM, Ribeiro J, Baracat EC, Abrão MS, Kho RM. Transvaginal Ultrasound for the Diagnosis of Adenomyosis: Systematic Review and Meta-Analysis. *J Minim Invasive Gynecol.* 2018 Feb;25(2):257-264. doi: 10.1016/j.jmig.2017.08.653. Epub 2017 Aug 30. PMID: 28864044.
- Zhai J, Vannuccini S, Petraglia F, Giudice LC. Adenomyosis: Mechanisms and Pathogenesis. *Semin Reprod Med.* 2020 May;38(2-03):129-143. doi: 10.1055/s-0040-1716687. Epub 2020 Oct 8. PMID: 33032339; PMCID: PMC7932680.
- Agostinho L, Cruz R, Osório F, Alves J, Setúbal A, Guerra A. MRI for adenomyosis: a pictorial review. *Insights Imaging.* 2017 Dec;8(6):549-556. doi: 10.1007/s13244-017-0576-z. Epub 2017 Oct 4. PMID: 28980163; PMCID: PMC5707223.
- An XL, Zhang J, Yun XC, Lei XH, Zhao J, Yang XH, Liu MM. Perspectives in transvaginal sonography for the diagnosis of adenomyosis. *Front Med (Lausanne).* 2025 Jun 19;12:1533648. doi: 10.3389/fmed.2025.1533648. PMID: 40612584; PMCID: PMC12224653.
- Atri M, Reinhold C, Mehio AR, Chapman WB, Bret PM. Adenomyosis: US features with histologic correlation in an in-vitro study. *Radiology.* 2000 Jun;215(3):783-90. doi: 10.1148/radiology.215.3.r00jn06783. PMID: 10831700.
- Foti PV, Farina R, Palmucci S, Vizzini IAA, Libertini N, Coronella M, Spadola S, Caltabiano R, Iraci M, Basile A, Milone P, Cianci A, Ettore GC. Endometriosis: clinical features, MR imaging findings and pathologic correlation. *Insights Imaging.* 2018 Apr;9(2):149-172. doi: 10.1007/s13244-017-0591-0. Epub 2018 Feb 15. PMID: 29450853; PMCID: PMC5893487.