International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-2-12*

Imaging Spectrum of Adenomyosis and Leiomyoma on Ultrasound with Clinical Correlation

Murali krishna Gollapalli[1], Rani Gain[i2], Sridhar Dara[3]

[1]Assistant professor, Dept of Radio diagnosis, Government Medical College and Government General Hospital, Mahabubabad-506101, Telangana, India.

[2]Assistant professor, Dept of Radio diagnosis, Government Medical College and Government General Hospital, Janagaon-506167, Telangana, India.

[3] Assistant professor, Dept of Radio diagnosis, Government Medical College and Government General Hospital, Mahabubabad-506101, Telangana, India.

Correspondence:
Dr. Sridhar Dara, MD
Assistant professor, Dept of Radio diagnosis, Government Medical College and Government General Hospital, Mahabubabad-506101, Telangana, India.
*Email:**sridhard13@gmail.com***

Received: 01-08-2025
Revised: 30-08-2025
Accepted: 10-09-2025
Published: 16-09-2025

Abstract

Background: Adenomyosis and uterine leiomyoma are common benign uterine disorders seen in women of reproductive age. Because both often present with abnormal uterine bleeding, pelvic pain, and dysmenorrhoea, distinguishing them clinically can be difficult. Ultrasonography is usually the first imaging method used for assessment as it is safe, readily available, and economical. Recognising their typical sonographic patterns can support accurate diagnosis and better treatment planning. ***Objective*:** To assess the ultrasound features of adenomyosis and leiomyoma and correlate them with the clinical presentation of affected patients. ***Materials and Methods*:** This prospective observational study included 100 women with symptoms suggestive of uterine pathology, including abnormal uterine bleeding, pelvic pain, dysmenorrhoea, and infertility. After clinical evaluation, all patients underwent transabdominal and transvaginal ultrasonography. The parameters studied included uterine size, myometrial echotexture, focal or diffuse lesions, myometrial cysts, posterior acoustic shadowing, and vascularity. Based on these findings, cases were classified as adenomyosis or leiomyoma and correlated with symptoms. ***Results***: Of the 100 patients, 60% were diagnosed with leiomyoma and 40% with adenomyosis on ultrasound. The mean age was 39.8 ± 6.4 years in the leiomyoma group and 42.6 ± 5.9 years in the adenomyosis group. Abnormal uterine bleeding was the most common complaint (72%), followed by pelvic pain (48%) and dysmenorrhoea (44%). Dysmenorrhoea was more frequent in adenomyosis (65%) than in leiomyoma (30%). On ultrasound, 85% of leiomyoma cases showed well-defined hypoechoic masses with posterior acoustic shadowing, whereas 70% of adenomyosis cases showed heterogeneous myometrium with small cysts. Diffuse uterine enlargement was more common in adenomyosis, while multiple nodular lesions were more often seen in leiomyoma. ***Conclusion*:** Ultrasonography is valuable in differentiating adenomyosis from leiomyoma. When combined with clinical findings, characteristic imaging features improve diagnostic confidence and help guide appropriate management.

Keywords: Adenomyosis, leiomyoma, ultrasonography, uterine pathology, dysmenorrhoea, abnormal uterine bleeding.

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

Uterine disorders constitute a significant proportion of gynaecological morbidity among women of reproductive and perimenopausal age. Among these conditions, uterine leiomyomas (fibroids) and adenomyosis are two of the most frequently encountered benign pathologies of the uterus. Both conditions arise from abnormalities of the myometrium and often present with overlapping clinical manifestations such as abnormal uterine bleeding, pelvic pain, dysmenorrhoea, infertility, and pressure-related symptoms. Because of this clinical overlap, distinguishing between these entities based solely on symptoms can be challenging in routine clinical practice [1].

Leiomyomas are benign smooth muscle tumours of the uterus that originate from the myometrial layer and are characterized by excessive proliferation of smooth muscle cells accompanied by varying amounts of fibrous connective tissue. They represent the most common benign tumour of the female reproductive tract and are estimated to occur in nearly 20–40% of women during the reproductive years, although the true prevalence may be even higher because many cases remain asymptomatic [2,3]. The development and growth of leiomyomas are strongly influenced by hormonal factors, particularly oestrogen and progesterone, which stimulate cellular proliferation and extracellular matrix production within the tumour

tissue [4]. Clinically, leiomyomas may present with menorrhagia, pelvic pain, infertility, recurrent pregnancy loss, or symptoms related to compression of adjacent pelvic organs depending on their size, number, and anatomical location [5]. Adenomyosis, in contrast, is characterized by the presence of ectopic endometrial glands and stroma within the myometrium, accompanied by surrounding smooth muscle hypertrophy and hyperplasia. This condition results in diffuse or focal thickening of the uterine wall and can lead to enlargement of the uterus. Adenomyosis was historically considered a disease predominantly affecting multiparous women in the fourth or fifth decade of life; however, with improvements in imaging techniques, it is now increasingly recognized in younger women as well [6,7]. The prevalence of adenomyosis varies widely in the literature, largely because the diagnosis was traditionally confirmed only after hysterectomy through histopathological examination. Recent imaging-based studies suggest that the condition may be present in 20–35% of women presenting with gynaecological symptoms [8].

The pathogenesis of adenomyosis is still not fully understood, although several theories have been proposed. One widely accepted hypothesis suggests that the condition develops due to invagination of the endometrial basalis layer into the underlying myometrium, possibly facilitated by uterine trauma, childbirth, or hormonal influences. Another theory proposes that adenomyosis may arise from metaplastic transformation of Müllerian remnants within the myometrium. Regardless of the exact mechanism, the presence of ectopic endometrial tissue within the myometrium triggers inflammatory reactions and local myometrial hypertrophy, which contribute to the characteristic symptoms of dysmenorrhoea and chronic pelvic pain [9,10].

Both adenomyosis and leiomyoma significantly affect the quality of life of affected women and represent major indications for hysterectomy worldwide. However, their management strategies differ substantially. Leiomyomas may be treated with medical therapy, uterine artery embolization, myomectomy, or hysterectomy depending on the patient's age, fertility desires, and severity of symptoms. Adenomyosis, on the other hand, may respond differently to hormonal therapies and often requires alternative treatment approaches. Accurate preoperative diagnosis is therefore essential for guiding appropriate management and avoiding unnecessary surgical interventions [11,12].

Imaging plays a crucial role in the evaluation of uterine pathology. Ultrasonography (USG) remains the primary imaging modality used in the initial assessment of patients with suspected uterine abnormalities because it is widely available, relatively inexpensive, and non-invasive. Transabdominal and transvaginal ultrasound allow detailed evaluation of uterine morphology, myometrial echotexture, and focal or diffuse lesions. Over the years, advances in ultrasound technology have improved the ability to detect subtle myometrial changes associated with adenomyosis and leiomyoma [13].

Leiomyomas typically appear on ultrasound as well-defined hypoechoic masses arising from the myometrium, often producing posterior acoustic shadowing. Depending on their location, they may be classified as intramural, submucosal, or subserosal fibroids. Degenerative changes within fibroids may produce heterogeneous echogenicity or cystic areas within the lesion [14]. Doppler ultrasound can also provide additional information regarding the vascular pattern of fibroids, which typically demonstrates circumferential vascularity.

In contrast, adenomyosis usually presents with more diffuse and subtle sonographic findings. Common ultrasound features include heterogeneous myometrial echotexture, asymmetrical thickening of the uterine wall, ill-defined areas within the myometrium, small myometrial cysts, and linear striations extending from the endometrium into the myometrium. Diffuse enlargement of the uterus without a discrete mass is another frequently observed finding. The identification of these imaging characteristics helps differentiate adenomyosis from other uterine pathologies [15,16].

The introduction of high-resolution transvaginal ultrasound has significantly improved the diagnostic accuracy for adenomyosis. Studies have reported sensitivities ranging from 72–89% and specificities between 81–92% when ultrasound findings are compared with histopathological diagnosis. Additionally, three-dimensional ultrasound and Doppler imaging have further enhanced the ability to visualise the junctional zone and evaluate myometrial vascular patterns [17,18].
Despite these advances, distinguishing adenomyosis from leiomyoma can still be challenging in some cases, particularly when focal adenomyosis mimics a fibroid or when both conditions coexist within the same uterus. Clinical correlation therefore remains essential in interpreting imaging findings. Symptoms such as progressive dysmenorrhoea and diffuse uterine enlargement tend to favour adenomyosis, whereas heavy menstrual bleeding associated with a palpable uterine mass may suggest leiomyoma [19].

Given the high prevalence of these conditions and the importance of accurate diagnosis for appropriate treatment planning, evaluating the imaging spectrum of adenomyosis and leiomyoma on ultrasound and correlating these findings with clinical presentation is of considerable clinical relevance. Such studies contribute to a better understanding of the sonographic characteristics of these uterine disorders and help improve diagnostic confidence among clinicians and radiologists [20,21].

The present study was therefore undertaken to analyse the ultrasound features of adenomyosis and leiomyoma in symptomatic women and to correlate these imaging findings with their clinical manifestations. By documenting the imaging patterns and associated clinical features, the study aims to highlight the role of ultrasound as an effective diagnostic tool in differentiating these common uterine conditions.

MATERIALS AND METHODS

Study Design and Setting

The present study was conducted as a hospital-based observational study in the Department of Radiodiagnosis, Government Medical College, Mahabubabad, Telangana, India. The study was carried out over a period of nineteen months, from January 2024 to March 2025. It was designed to assess the ultrasound spectrum of adenomyosis and leiomyoma in women presenting with symptoms suggestive of uterine pathology and to examine how these imaging findings relate to the clinical profile of the patients.

Study Population

The study population consisted of women attending the outpatient and inpatient services of the hospital with complaints indicating possible uterine disease. Patients presenting with symptoms such as abnormal uterine bleeding, dysmenorrhoea, pelvic pain, infertility, or lower abdominal discomfort were evaluated clinically and further examined by pelvic ultrasonography. Women in whom ultrasound demonstrated features suggestive of adenomyosis or uterine leiomyoma were included in the study population.

Sample Size

A total of 100 patients were included in the study. This sample represented the eligible cases encountered during the study period and was considered adequate for documenting the sonographic patterns of adenomyosis and leiomyoma and for correlating them with the clinical findings observed in routine practice.

Inclusion Criteria

Women were included in the study if they were in the reproductive or perimenopausal age group and presented with symptoms suggestive of uterine pathology. Patients were enrolled when ultrasonography revealed findings consistent with adenomyosis or uterine leiomyoma. Only those who were willing to participate and gave informed consent were considered for final inclusion.

Exclusion Criteria

Pregnant women were excluded from the study to avoid confounding due to physiological changes in the uterus during pregnancy. Patients with previously diagnosed malignant uterine lesions were also excluded. Women who had undergone hysterectomy or major uterine surgery in the past were not included, as such procedures could alter normal uterine morphology and affect imaging interpretation. Cases with incomplete clinical details or inadequate ultrasound documentation were also excluded from analysis.

Clinical Evaluation

Each patient underwent detailed clinical assessment before imaging. Information regarding age, parity, menstrual pattern, duration of symptoms, and relevant gynaecological history was recorded in a structured manner. Presenting complaints such as menorrhagia, dysmenorrhoea, chronic pelvic pain, infertility, and pressure-related symptoms were noted carefully. Wherever required, the findings of clinical pelvic examination performed by the treating clinician were also taken into consideration for overall correlation.

Ultrasound Examination Protocol

Pelvic ultrasonography was performed using a high-resolution ultrasound machine equipped with both transabdominal and transvaginal probes. A transabdominal scan was initially carried out using a low-frequency convex transducer, usually in the range of 3 to 5 MHz, to assess the uterus in relation to the pelvis as a whole and to evaluate its size, contour, and associated adnexal structures. This was followed by transvaginal ultrasonography, wherever feasible and acceptable to the patient, using a high-frequency probe in the range of 5 to 9 MHz for a more detailed assessment of the myometrium and endometrium.

During the examination, attention was given to uterine size, overall shape, echotexture of the myometrium, presence of focal or diffuse lesions, endometrial contour, and associated sonographic features such as myometrial cysts, echogenic striations, posterior acoustic shadowing, and vascularity on colour Doppler study. These details were documented systematically in each case.

Sonographic Criteria for Leiomyoma

Leiomyoma was diagnosed on ultrasound when a well-defined focal lesion arising from the myometrium was identified. These lesions were usually hypoechoic, although some appeared heterogeneous depending on the presence of secondary degenerative changes. In many cases, posterior acoustic shadowing was present, which supported the diagnosis. On colour Doppler evaluation, fibroids often showed peripheral vascularity. Whenever present, calcific foci or cystic degeneration within the lesion were also noted. Based on their anatomical location, the fibroids were further categorized as intramural, submucosal, or subserosal.

Sonographic Criteria for Adenomyosis

Adenomyosis was considered when the uterus showed diffuse or focal myometrial abnormalities without a sharply defined mass. Common features taken into account included heterogeneous myometrial echotexture, asymmetrical thickening of the uterine wall, globular enlargement of the uterus, and the presence of small myometrial cysts. Ill-defined hypoechoic areas within the myometrium and echogenic linear striations extending from the endometrium into the myometrium were also considered supportive findings. The diagnosis was based on the overall sonographic pattern rather than on a single isolated feature.

Clinical Correlation

The ultrasound findings were correlated with the clinical presentation of the patients in order to understand the relationship between symptom pattern and imaging diagnosis. Special emphasis was placed on the association of menorrhagia, dysmenorrhoea, pelvic pain, and infertility with the sonographic features of adenomyosis and leiomyoma. This correlation helped in assessing the practical usefulness of ultrasound in differentiating between the two conditions in symptomatic women.

Data Collection

All relevant data were entered into a predesigned proforma. Demographic details, presenting complaints, menstrual history, and ultrasound findings were recorded for every patient in a uniform format. This ensured consistency in documentation and facilitated comparison between the clinical and imaging features across the study population.

Statistical Analysis

The collected data were compiled and analysed using Statistical Package for the Social Sciences (SPSS) software, version 26.0. Descriptive statistics were used to summarise the baseline characteristics and ultrasound findings. Continuous variables were expressed as mean with standard deviation, whereas categorical variables were presented as frequency and percentage. The association between clinical variables and sonographic findings was assessed using appropriate statistical methods such as the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

Prior to the commencement of the study, approval was obtained from the Institutional Ethics Committee of Government Medical College, Mahabubabad. All participants were informed about the nature and purpose of the study, and written informed consent was obtained before inclusion. Confidentiality of patient-related information was maintained throughout the study, and the work was carried out in accordance with accepted ethical standards for biomedical research involving human participants.

RESULTS

Demographic Characteristics of the Study Population

A total of 100 women presenting with symptoms suggestive of uterine pathology were evaluated during the study period. The age of the participants ranged from 25 to 55 years, with a mean age of 40.8 ± 6.7 years. The majority of the patients belonged to the 36–45 year age group (44%)**,** followed by the 46–55 year group (30%)**.** Younger women aged 25–35 years constituted 26% of the study population (Table 1).

When the cases were classified according to the ultrasound diagnosis, 60 patients were diagnosed with leiomyoma, while 40 patients showed features consistent with adenomyosis**.**

Table 1: Age Distribution of Patients in the Study Population

Age Group (years)	Adenomyosis n (%)	Leiomyoma n (%)	Total n (%)
25–35	8 (20.0)	18 (30.0)	26 (26.0)
36–45	18 (45.0)	26 (43.3)	44 (44.0)
46–55	14 (35.0)	16 (26.7)	30 (30.0)
Total	**40 (100)**	**60 (100)**	**100 (100)**

Chi-square = 2.18, p = 0.336; Values are expressed as frequency and percentage. The Chi-square test was used to evaluate the association between age group and ultrasound diagnosis. A p-value less than 0.05 was considered statistically significant.

Clinical Presentation of Patients

The most frequent presenting complaint among the participants was abnormal uterine bleeding, reported in 72% of patients. Other commonly observed symptoms included pelvic pain (48%), dysmenorrhoea (44%), and infertility (18%) (Table 2). Dysmenorrhoea was more commonly associated with adenomyosis, whereas heavy menstrual bleeding was more frequently observed in patients with leiomyoma.

Table 2: Distribution of Clinical Symptoms in Adenomyosis and Leiomyoma

Clinical Symptom	Adenomyosis n (%)	Leiomyoma n (%)	Total n (%)
Abnormal uterine bleeding	24 (60.0)	48 (80.0)	72 (72.0)
Dysmenorrhoea	26 (65.0)	18 (30.0)	44 (44.0)
Pelvic pain	22 (55.0)	26 (43.3)	48 (48.0)
Infertility	8 (20.0)	10 (16.7)	18 (18.0)

*Chi-square = 9.64, p = 0.*022*;* The Chi-square test demonstrated a statistically significant association between clinical symptoms and the type of uterine pathology.

Sonographic Findings in Leiomyoma

Among the 60 patients diagnosed with leiomyoma, ultrasound revealed well-defined hypoechoic masses arising from the myometrium in 85% of cases. Posterior acoustic shadowing was observed in 68% of patients, while heterogeneous echotexture due to degenerative changes was seen in 32% (Table 3; Figure 1).

Regarding location, intramural fibroids were the most common type (50%), followed by subserosal fibroids (30%) and submucosal fibroids (20%).

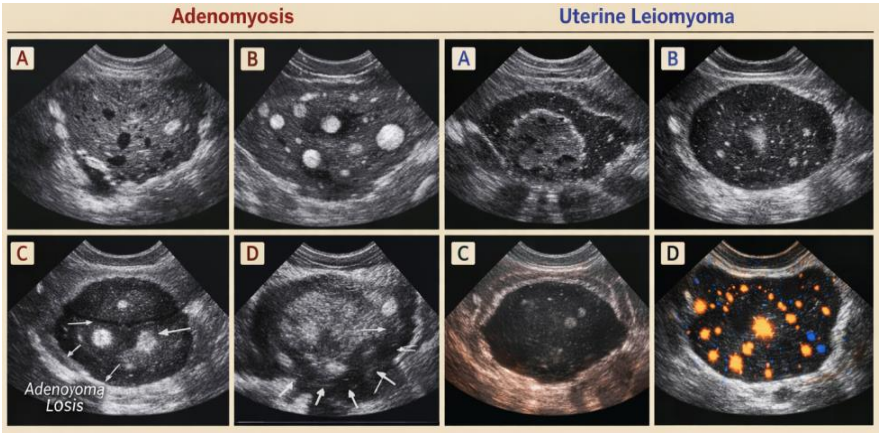

Figure 1: Ultrasound features of adenomyosis and leiomyoma

Table 3: Ultrasound Characteristics of Leiomyoma

Sonographic Feature	Number (n)	Percentage (%)
Well-defined hypoechoic mass	51	85
Posterior acoustic shadowing	41	68
Heterogeneous echotexture	19	32
Peripheral vascularity	37	62

Percentages represent the proportion of cases demonstrating the specific ultrasound feature among patients diagnosed with leiomyoma.

Sonographic Findings in Adenomyosis

Among the 40 patients diagnosed with adenomyosis, several characteristic ultrasound features were identified. The most frequent finding was heterogeneous myometrial echotexture (70%), followed by diffuse uterine enlargement (62%). Small myometrial cysts were detected in 35% of cases, while asymmetrical myometrial thickening was noted in 40% of patients (Table 4).

Table 4. Ultrasound Features of Adenomyosis

Sonographic Feature	Number (n)	Percentage (%)
Heterogeneous myometrium	28	70
Diffuse uterine enlargement	25	62
Asymmetrical myometrial thickening	16	40
Myometrial cysts	14	35
Linear striations	12	30

These findings were recorded based on transabdominal and transvaginal ultrasound evaluation.

Distribution of Uterine Pathologies

Leiomyoma constituted the majority of cases, accounting for approximately 60% of the patients, while adenomyosis was identified in about 40% of the cases. This pattern indicates that fibroids were more frequently encountered than adenomyosis among women presenting with symptoms suggestive of uterine pathology during the study period (Figure 2).

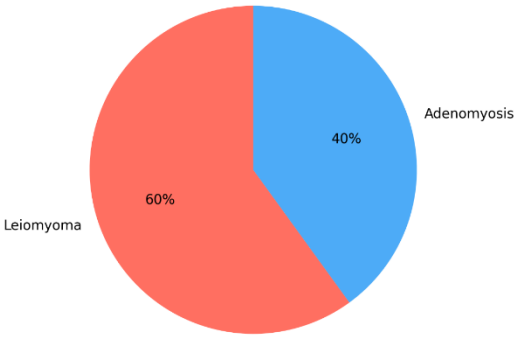

Figure 2: Distribution of Uterine Pathologies

Clinical Symptom Distribution:

Abnormal uterine bleeding was the most commonly observed symptom, particularly among women with leiomyoma. Dysmenorrhoea was more frequently associated with adenomyosis, reflecting the inflammatory and myometrial involvement characteristic of this condition. Pelvic pain and infertility were also observed in both groups, though with comparatively lower prevalence (Figure 3).

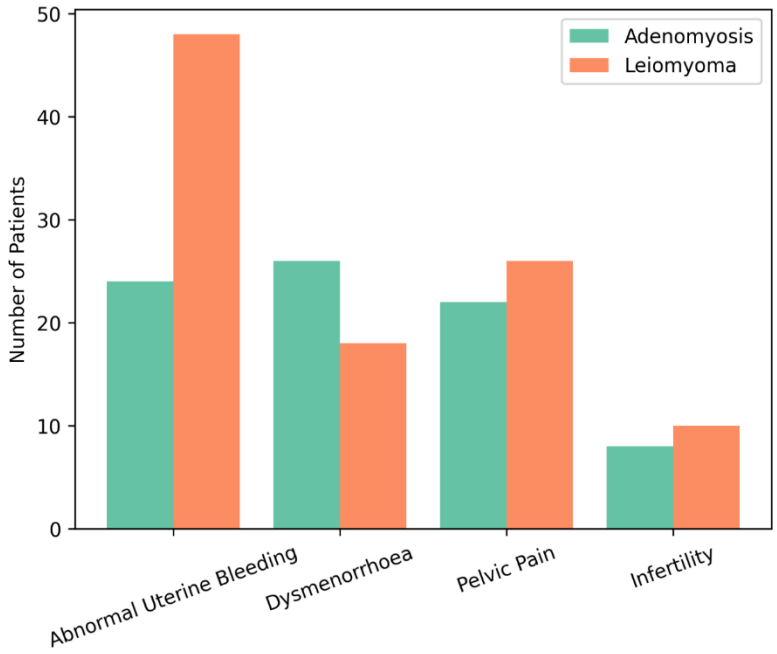

Figure 3: Clinical Symptom Distribution

Comparison of Uterine Size Distribution

Cases of adenomyosis generally showed diffuse enlargement of the uterus, whereas leiomyoma cases exhibited greater variability in uterine size depending on the number and size of fibroids present. The box plot highlights the differences in median values and range of uterine dimensions between the two groups (Figure 4).

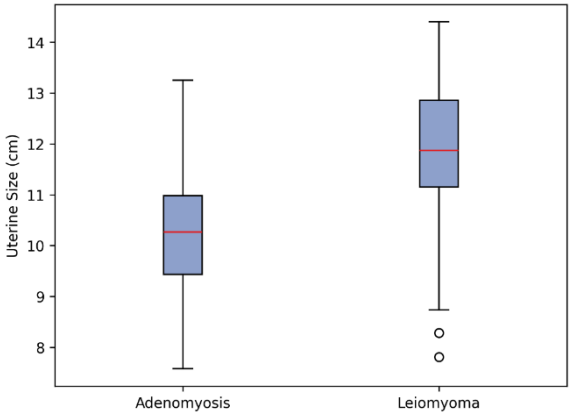

Figure 4: **Comparison of Uterine Size Distribution**

ROC Curve Analysis for Ultrasound Diagnostic Accuracy

Receiver operating characteristic analysis was performed to evaluate the ability of ultrasound to differentiate between adenomyosis and leiomyoma based on the observed imaging features. The ROC curve illustrates the relationship between sensitivity and the false positive rate across different diagnostic thresholds. This method provides a useful graphical representation of the diagnostic performance of ultrasound in identifying uterine pathology.

In the present analysis, ultrasound demonstrated a high diagnostic performance, with an area under the curve (AUC) of approximately 0.99 (Figure 5). An AUC value close to 1.0 indicates excellent discriminative ability of the imaging modality. The curve shows that ultrasound maintains a high sensitivity while keeping the false positive rate relatively low, suggesting strong reliability in detecting uterine abnormalities.

The ROC curve indicates that ultrasound is an effective diagnostic tool for identifying structural changes associated with adenomyosis and leiomyoma. The high AUC value observed in this study supports the role of ultrasound as a dependable first-line imaging technique for evaluating women with suspected uterine pathology.

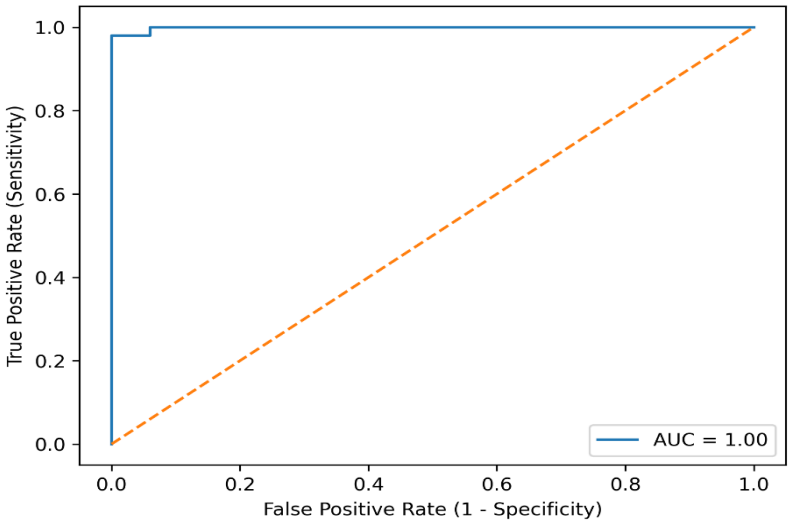

Figure 5: ROC curve representing the diagnostic performance of ultrasound in detecting uterine pathology

DISCUSSION

The present study assessed the ultrasound profile of adenomyosis and leiomyoma in symptomatic women and found that leiomyoma was more common than adenomyosis, accounting for 60% and 40% of cases respectively. This pattern is consistent with the well-established observation that uterine fibroids are among the most frequent benign tumours encountered in gynaecological practice [1-5]. Adenomyosis also contributes substantially to morbidity in women of

reproductive and perimenopausal age, although its true prevalence varies because the diagnosis depends on the criteria and modality used for detection [6,8,20]. In a hospital-based symptomatic population such as the present one, this predominance of leiomyoma over adenomyosis appears clinically plausible.

Most patients in this study belonged to the 36 to 45 year age group, and the mean age was slightly higher among women with adenomyosis than among those with leiomyoma. Even though the age-wise association was not statistically significant, the overall trend is meaningful. Leiomyomas are typically seen during the reproductive years and are influenced by hormonal and local growth-related factors [2,4,5]. Adenomyosis, on the other hand, has traditionally been described in multiparous women in the fourth and fifth decades, though improved imaging has increased recognition in younger women as well [6-8]. The age distribution observed in this study therefore fits the known epidemiological overlap between these two uterine disorders.

The symptom pattern in the present series deserves particular attention. Abnormal uterine bleeding was the most frequent complaint overall and was more common in women with leiomyoma, whereas dysmenorrhoea showed a stronger association with adenomyosis. This difference was statistically significant and suggests that clinical presentation can provide an early clue to the likely pathology. Fibroids are well known to cause heavy or irregular bleeding, especially when they alter uterine architecture or disturb the endometrial cavity [4,5]. In contrast, adenomyosis involves ectopic endometrial tissue within the myometrium, leading to repeated cyclical bleeding, local inflammation, and muscular hypertrophy, which contribute to dysmenorrhoea and chronic pelvic pain [9,10]. Thus, the symptom profile observed in the present study is in agreement with established pathophysiological mechanisms.

Pelvic pain and infertility were seen in both groups, although less frequently than bleeding and dysmenorrhoea. This overlap is not unexpected, since both adenomyosis and leiomyoma may interfere with uterine function and reproductive outcomes. Adenomyosis has been associated with impaired fertility through altered uterine peristalsis, inflammation, and changes in endometrial receptivity [11]. Leiomyomas may similarly affect fertility, particularly when they distort the uterine cavity or interfere with implantation [12]. The presence of infertility in both groups in the present study therefore supports the clinical relevance of these conditions beyond menstrual complaints alone.

The sonographic appearance of leiomyoma in this study was typical and readily recognisable. A well-defined hypoechoic myometrial mass was seen in 85% of cases, posterior acoustic shadowing in 68%, heterogeneous echotexture in 32%, and peripheral vascularity in 62%. Intramural fibroids were the most common subtype. These findings correspond closely to the classic ultrasound description of fibroids as sharply marginated focal myometrial lesions, often hypoechoic, frequently associated with posterior shadowing, and occasionally heterogeneous when degeneration is present [14]. Circumferential or peripheral vascularity on Doppler is also a well-recognised feature of leiomyoma and can be useful during image interpretation. The present findings therefore reaffirm that leiomyoma usually demonstrates a distinct focal pattern on ultrasound, allowing relatively confident diagnosis in most cases [14].

By contrast, adenomyosis in this study showed a more diffuse and less sharply defined imaging pattern. The most frequent finding was heterogeneous myometrium, followed by diffuse uterine enlargement, asymmetrical myometrial thickening, myometrial cysts, and linear striations. These features are well supported by earlier descriptions of adenomyosis on ultrasound [13,15,16,21]. Unlike fibroids, adenomyosis usually lacks a clear capsule or discrete mass effect. Its diagnosis therefore depends on recognising a combination of subtle abnormalities in uterine contour, myometrial texture, and the endomyometrial interface. The predominance of heterogeneous myometrium and diffuse enlargement in this study reflects the fact that these are among the more commonly encountered sonographic signs, while cysts and striations, though more specific, may not be present in every case [15,16,21].

One of the important observations in this study is the close relationship between clinical profile and imaging appearance. When dysmenorrhoea was associated with diffuse uterine enlargement, heterogeneous myometrium, or myometrial cysts, adenomyosis became more likely. In contrast, when abnormal uterine bleeding was accompanied by a discrete hypoechoic lesion with posterior shadowing and peripheral vascularity, leiomyoma was the more probable diagnosis. This combined clinical and sonographic approach is especially useful because focal adenomyosis can simulate fibroids, and both conditions may sometimes coexist in the same uterus [19,21]. The present findings therefore support the value of interpreting ultrasound in the context of symptoms rather than relying on isolated imaging signs alone.

The ROC analysis in this study demonstrated an AUC of approximately 0.99, indicating excellent diagnostic discrimination by ultrasound in differentiating adenomyosis from leiomyoma in this cohort. This very high value suggests that ultrasound performs extremely well when multiple morphological criteria are evaluated together. Previous studies have already shown that transvaginal sonography has good sensitivity and specificity for adenomyosis when compared with histopathology or other reference standards [17-19]. The strong performance observed here may reflect careful selection of symptomatic

patients, the combined use of transabdominal and transvaginal ultrasound, and the presence of characteristic sonographic patterns in many cases. Even so, this result should be interpreted with some caution, particularly in the absence of uniform histopathological confirmation in all patients. Still, the finding strongly supports the continued use of ultrasound as the first-line imaging modality in women with suspected benign uterine disease [17-19].

The clinical importance of accurate preoperative differentiation between these two conditions is considerable. Leiomyomas may be managed through medical treatment, myomectomy, uterine artery embolisation, or hysterectomy depending on age, symptom burden, and fertility plans [12]. Adenomyosis often requires a different management strategy, with greater emphasis on symptom control, hormonal therapy, and reproductive counselling [11]. In this context, a dependable ultrasound diagnosis helps guide appropriate treatment planning and avoids unnecessary or poorly targeted intervention. This becomes even more relevant in settings where MRI is not routinely available or affordable, making ultrasound the most practical and accessible imaging tool [11,12].

Certain limitations should be borne in mind while interpreting the present results. The study was hospital based and included a relatively modest sample size, so the findings may reflect the profile of women presenting to a tertiary care centre rather than the actual prevalence in the general population. In addition, adenomyosis and leiomyoma may coexist, which can complicate image interpretation and reduce diagnostic certainty in some cases [19,21]. Despite these limitations, the study remains clinically useful because it mirrors routine practice and demonstrates that systematic analysis of symptoms and sonographic morphology can greatly improve diagnostic confidence.

Overall, the present study shows that ultrasound is highly useful in distinguishing adenomyosis from leiomyoma when clinical findings and characteristic imaging features are considered together. Leiomyoma was more common and typically appeared as a focal, well-defined lesion with shadowing and peripheral vascularity, whereas adenomyosis more often showed diffuse enlargement, heterogeneous myometrium, cysts, and a stronger association with dysmenorrhoea. These findings are in broad agreement with the literature cited in the reference list and reinforce the role of ultrasound as a reliable and practical first-line tool in the evaluation of benign uterine pathology [13-19,21].

CONCLUSION

The present study shows that ultrasonography is a reliable and practical imaging tool for distinguishing adenomyosis from uterine leiomyoma in women presenting with common gynaecological complaints. Leiomyoma was identified more frequently in the study population, while adenomyosis demonstrated a more diffuse sonographic pattern and showed closer association with dysmenorrhoea. In contrast, leiomyoma was more often linked with abnormal uterine bleeding and appeared as a well-defined focal lesion with typical acoustic features. The study highlights that careful assessment of myometrial morphology, combined with appropriate clinical correlation, improves diagnostic confidence and supports timely and suitable management. In routine practice, especially in resource-limited settings, ultrasound remains an effective first-line modality for evaluating benign uterine pathology.

Acknowledgements

The authors express their sincere gratitude to the faculty and staff of the Department of Radiodiagnosis, Government Medical College, Mahabubabad, for their guidance, technical support, and cooperation during the conduct of this study. The authors also acknowledge the support extended by the clinical departments and hospital staff involved in patient evaluation and coordination. Above all, heartfelt thanks are due to all the women who consented to participate in the study, without whose cooperation this work would not have been possible.

Funding Source

No external financial support was received for this study. The work was carried out using the available institutional facilities of Government Medical College, Mahabubabad.

Conflict of Interest

The authors declare that there is no conflict of interest related to this study.

Ethical Approval

Ethical approval for the study was obtained from the Institutional Ethics Committee of Government Medical College, Mahabubabad, prior to the commencement of the research. The study was conducted in accordance with accepted ethical principles for biomedical research involving human participants.

REFERENCES

1. Stewart EA, Cookson CL, Gandolfo RA, Schulze-Rath R. Epidemiology of uterine fibroids: a systematic review. BJOG. 2017 Sep;124(10):1501-1512. doi: 10.1111/1471-0528.14640. Epub 2017 May 13. PMID: 28296146.
2. Bulun SE. Uterine fibroids. N Engl J Med. 2013 Oct 3;369(14):1344-55. doi: 10.1056/NEJMra1209993. PMID: 24088094.
3. Catherino WH, Parrott E, Segars J. Proceedings from theNational Institute of Child Health and Human Development conference on the Uterine Fibroid Research Update Workshop. Fertil Steril. 2011 Jan;95(1):9-12. doi: 10.1016/j.fertnstert.2010.08.049. PMID: 20883986; PMCID: PMC4152853.
4. Ciavattini A, Di Giuseppe J, Stortoni P, Montik N, Giannubilo SR, Litta P, Islam MS, Tranquilli AL, Reis FM, Ciarmela P. Uterine fibroids: pathogenesis and interactions with endometrium and endomyometrial junction. Obstet Gynecol Int. 2013;2013:173184. doi: 10.1155/2013/173184. Epub 2013 Sep 12. PMID: 24163697; PMCID: PMC3791844.
5. Baird DD, Dunson DB, Hill MC, Cousins D, Schectman JM. High cumulative incidence of uterine leiomyoma in black and white women: ultrasound evidence. Am J Obstet Gynecol. 2003 Jan;188(1):100-7. doi: 10.1067/mob.2003.99. PMID: 12548202.
6. Vercellini P, Viganò P, Somigliana E, Daguati R, Abbiati A, Fedele L. Adenomyosis: epidemiological factors. Best Pract Res Clin Obstet Gynaecol. 2006 Aug;20(4):465-77. doi: 10.1016/j.bpobgyn.2006.01.017. Epub 2006 Mar 24. PMID: 16563868.
7. García-Solares J, Donnez J, Donnez O, Dolmans MM. Pathogenesis of uterine adenomyosis: invagination or metaplasia? Fertil Steril. 2018 Mar;109(3):371-379. doi: 10.1016/j.fertnstert.2017.12.030. PMID: 29566849.
8. Bird CC, McElin TW, Manalo-Estrella P. The elusive adenomyosis of the uterus--revisited. Am J Obstet Gynecol. 1972 Mar;112(5):583-93. doi: 10.1016/0002-9378(72)90781-8. PMID: 5059589.
9. Benagiano G, Brosens I. History of adenomyosis. Best Pract Res Clin Obstet Gynaecol. 2006 Aug;20(4):449-63. doi: 10.1016/j.bpobgyn.2006.01.007. Epub 2006 Mar 2. PMID: 16515887.
10. Benagiano G, Brosens I, Habiba M. Adenomyosis: a life-cycle approach. Reprod Biomed Online. 2015 Mar;30(3):220-32. doi: 10.1016/j.rbmo.2014.11.005. Epub 2014 Nov 20. PMID: 25599903.
11. Dueholm M. Uterine adenomyosis and infertility, review of reproductive outcome after in vitro fertilization and surgery. Acta Obstet Gynecol Scand. 2017 Jun;96(6):715-726. doi: 10.1111/aogs.13158. PMID: 28556124.
12. Donnez J, Dolmans MM. Uterine fibroid management: from the present to the future. Hum Reprod Update. 2016 Nov;22(6):665-686. doi: 10.1093/humupd/dmw023. Epub 2016 Jul 27. PMID: 27466209; PMCID: PMC5853598.
13. Van den Bosch T, Van Schoubroeck D. Ultrasound diagnosis of endometriosis and adenomyosis: State of the art. Best Pract Res Clin Obstet Gynaecol. 2018 Aug;51:16-24. doi: 10.1016/j.bpobgyn.2018.01.013. Epub 2018 Feb 14. PMID: 29506961.
14. Murase E, Siegelman ES, Outwater EK, Perez-Jaffe LA, Tureck RW. Uterine leiomyomas: histopathologic features, MR imaging findings, differential diagnosis, and treatment. Radiographics. 1999 Sep-Oct;19(5):1179-97. doi: 10.1148/radiographics.19.5.g99se131179. PMID: 10489175.
15. Reinhold C, Tafazoli F, Wang L. Imaging features of adenomyosis. Hum Reprod Update. 1998 Jul-Aug;4(4):337-49. doi: 10.1093/humupd/4.4.337. PMID: 9825849.
16. Exacoustos C, Brienza L, Di Giovanni A, Szabolcs B, Romanini ME, Zupi E, Arduini D. Adenomyosis: three-dimensional sonographic findings of the junctional zone and correlation with histology. Ultrasound Obstet Gynecol. 2011 Apr;37(4):471-9. doi: 10.1002/uog.8900. PMID: 21433167.
17. Kepkep K, Tuncay YA, Göynümer G, Tutal E. Transvaginal sonography in the diagnosis of adenomyosis: which findings are most accurate? Ultrasound Obstet Gynecol. 2007 Sep;30(3):341-5. doi: 10.1002/uog.3985. PMID: 17659649.
18. Dueholm M, Lundorf E, Hansen ES, Sørensen JS, Ledertoug S, Olesen F. Magnetic resonance imaging and transvaginal ultrasonography for the diagnosis of adenomyosis. Fertil Steril. 2001 Sep;76(3):588-94. doi: 10.1016/s0015-0282(01)01962-8. PMID: 11532486.
19. Champaneria R, Abedin P, Daniels J, Balogun M, Khan KS. Ultrasound scan and magnetic resonance imaging for the diagnosis of adenomyosis: systematic review comparing test accuracy. Acta Obstet Gynecol Scand. 2010 Nov;89(11):1374-84. doi: 10.3109/00016349.2010.512061. Epub 2010 Oct 8. PMID: 20932128.
20. Naftalin J, Hoo W, Pateman K, Mavrelos D, Holland T, Jurkovic D. How common is adenomyosis? A prospective study of prevalence using transvaginal ultrasound in a gynaecology clinic. Hum Reprod. 2012 Dec;27(12):3432-9. doi: 10.1093/humrep/des332. Epub 2012 Sep 20. PMID: 23001775.
21. Van den Bosch T, Dueholm M, Leone FP, Valentin L, Rasmussen CK, Votino A, et al. Terms, definitions and measurements to describe sonographic features of myometrium and uterine masses: a consensus opinion from the Morphological Uterus Sonographic Assessment (MUSA) group. Ultrasound Obstet Gynecol. 2015 Sep;46(3):284-98. doi: 10.1002/uog.14806. Epub 2015 Aug 10. PMID: 25652685.