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COMPARISON OF ULTRASOUND AND HISTOPATHOLOGY IN THE DIAGNOSIS OF ADENOMYOSIS

Original Research

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ABSTRACT

Background: Adenomyosis is a benign gynecological disorder characterized by the invasion of endometrial tissue into the myometrium, often presenting with abnormal uterine bleeding, dysmenorrhea, and infertility. Although histopathology remains the gold standard for diagnosis, its invasive nature limits its use. Transvaginal ultrasound (TVUS) offers a non-invasive, accessible, and cost-effective diagnostic alternative, particularly in low-resource settings.

Objective: This study aimed to compare the diagnostic performance of transvaginal ultrasound with histopathology for detecting adenomyosis and to identify clinical predictors associated with histopathology-confirmed disease.

Methods: A cross-sectional comparative study was conducted among 93 women aged 20–50 years who underwent hysterectomy at the Department of Obstetrics and Gynecology, Mayo Hospital, King Edward Medical University, Lahore, between February and July 2025. All participants underwent preoperative transvaginal ultrasonography, followed by histopathological examination of surgical specimens. Demographic, clinical, and sonographic data were recorded. Diagnostic accuracy indices—sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy—were calculated using histopathology as the gold standard. Logistic regression analysis was performed to identify significant predictors of adenomyosis.

Results: The mean age of participants was 41.8 ± 6.9 years, with most being multiparous (75.3%) and premenopausal (62.4%). Abnormal uterine bleeding was reported in 69.9% of women, followed by dysmenorrhea in 55.9%. Histopathology confirmed adenomyosis in 53 (57.0%) cases. Ultrasound demonstrated a sensitivity of 86.8%, specificity of 70.0%, PPV of 79.3%, NPV of 80.0%, and overall diagnostic accuracy of 79.6%. Logistic regression identified positive ultrasound findings (OR = 8.15, $p < 0.001$), abnormal uterine bleeding (OR = 3.49, $p = 0.005$), parity ≥3 (OR = 2.48, $p = 0.021$), and age ≥40 years (OR = 2.32, $p = 0.038$) as independent predictors of histopathology-confirmed adenomyosis.

Conclusion: Transvaginal ultrasound provides high diagnostic sensitivity and acceptable specificity for detecting adenomyosis and is especially effective in multiparous, premenopausal women with abnormal uterine bleeding. While histopathology remains definitive, ultrasound serves as a reliable, non-invasive, and cost-effective first-line diagnostic modality in routine clinical practice.

Keywords: Adenomyosis; Abnormal uterine bleeding; Diagnostic accuracy; Histopathology; Predictive value; Transvaginal ultrasonography; Uterine diseases.

INTRODUCTION

Adenomyosis is a common yet often underdiagnosed gynecological disorder characterized by the infiltration of endometrial glands and stroma into the myometrium, leading to uterine enlargement, menorrhagia, dysmenorrhea, and infertility (1). Although benign, adenomyosis frequently coexists with leiomyomas, making clinical differentiation challenging. Both conditions contribute significantly to abnormal uterine bleeding and are leading causes of hysterectomy in women of reproductive and perimenopausal age (1). The condition, also referred to as internal endometriosis, is hypothesized to arise from excessive proliferation or invagination of the endometrium into the myometrium, or due to mechanical disruption of the endometrial–myometrial interface during events such as pregnancy, delivery, endometrial curettage, cesarean section, or uterine surgery like myomectomy or metroplasty (2–4). The true prevalence of adenomyosis remains uncertain due to its frequently asymptomatic course and the reliance on histopathological confirmation, which is typically unavailable in conservatively managed cases. It is reported in 20–47% of women undergoing hysterectomy for benign gynecological conditions (1), while some studies have observed its occurrence in approximately 30% of women aged 18–30 years (2). Identified risk factors include multiparity, prior uterine surgeries that breach the myo-endometrial junction, and genetic predispositions such as matrix metalloproteinase promoter polymorphism (3). Clinically, adenomyosis presents with a broad and heterogeneous spectrum ranging from mild pelvic discomfort to severe dysmenorrhea, menometrorrhagia, or dyspareunia, though many cases remain asymptomatic (4). Definitive diagnosis relies on histopathological evidence, typically characterized by endometrial glands located more than 2.5 mm beneath the endometrial–myometrial junction (5). However, non-invasive diagnostic imaging modalities have increasingly been adopted to improve detection and management. Among these, transabdominal ultrasonography (TAS), transvaginal ultrasonography (TVS), and magnetic resonance imaging (MRI) are most frequently utilized (6–9).

Sonography, particularly TVS, remains the preferred first-line modality due to its accessibility, affordability, and real-time visualization. Common sonographic indicators include a globular uterine contour, myometrial heterogeneity, asymmetrical thickening of uterine walls, subendometrial cysts, hypoechoic striations, and irregularities in the junctional zone (10). Adenomyosis may manifest in various forms, including diffuse internal adenomyosis, external adenomyosis often associated with deep endometriosis, and localized adenomyoma (11,12). The diffuse internal type, which diffusely involves the myometrium, poses greater diagnostic difficulty and clinical management challenges. Differentiating adenomyosis from leiomyoma remains crucial, as the two entities have distinct therapeutic approaches—medical therapy being the mainstay for adenomyosis, while surgical management is more often indicated for leiomyoma or mixed pathology. Despite advancements in imaging, diagnostic discrepancies persist between sonographic and histopathologic findings. Therefore, determining the accuracy of ultrasonography as a diagnostic tool is essential for guiding treatment decisions, particularly in settings where MRI is not readily available. The present study was designed to compare the diagnostic accuracy of ultrasonography with histopathological findings in detecting adenomyosis, assessing its sensitivity, specificity, positive predictive value, and negative predictive value to validate its clinical reliability.

METHODS

This cross-sectional comparative study was conducted in the Department of Obstetrics and Gynecology, Mayo Hospital, King Edward Medical University (KEMU), Lahore, over a six-month period from February 1, 2025, to July 31, 2025. A total of 93 women were enrolled using a stratified random sampling technique to ensure proportional representation across varying age groups and parity levels. The research design was structured to evaluate the diagnostic accuracy of preoperative transvaginal ultrasonography (TVS) against histopathology, considered the gold standard, in detecting adenomyosis among women undergoing hysterectomy for benign gynecological indications. Women aged 20 to 50 years presenting with symptoms suggestive of adenomyosis—such as dysmenorrhea, chronic pelvic pain, and abnormal uterine bleeding—who were scheduled for hysterectomy were considered eligible for inclusion. Only those who consented to both preoperative TVS and postoperative histopathological evaluation of the surgical specimen were included. Patients were excluded if they had a confirmed diagnosis of other uterine pathologies (such as fibroids or endometriosis), a history of previous uterine surgery (including cesarean section or myomectomy), pregnancy at the time of recruitment, or incomplete clinical or histopathological data. These criteria were designed to minimize confounding variables that could obscure the diagnostic accuracy of ultrasound findings. Ethical approval for the study was obtained from the Ethical Review Committee of Superior University, Lahore

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and all study procedures adhered to institutional and ethical guidelines for research involving human participants. Written informed consent was obtained from each participant after providing a detailed explanation of the study objectives, procedures, and potential implications. Participants were assured of confidentiality, anonymity, and their right to withdraw from the study at any point without any penalty or effect on their medical care.

Data collection was carried out using a structured, prevalidated questionnaire and standardized case proforma. Socio-demographic and clinical data such as age, parity, body mass index (BMI), residence, educational status, menstrual pattern, and reproductive history were documented. Clinical findings, including uterine size and tenderness, were recorded during gynecological examination. Each participant underwent a preoperative transvaginal ultrasound performed by an experienced radiologist with at least five years of experience in gynecologic imaging. Ultrasound evaluation followed standardized diagnostic criteria for adenomyosis, which included heterogeneous myometrial echotexture, myometrial cysts, poor definition of the endometrial–myometrial junction, asymmetrical thickening of uterine walls, and the presence of subendometrial striations. These findings were documented before surgery to avoid any potential bias introduced by histopathological outcomes. Following hysterectomy, uterine specimens were sent to the pathology department, where histopathological examination was performed by a senior histopathologist blinded to the ultrasound findings. The diagnosis of adenomyosis was confirmed by identifying ectopic endometrial glands and stroma located within the myometrium, typically accompanied by surrounding smooth muscle hyperplasia. The histopathological results were used as the reference standard for determining the diagnostic accuracy of ultrasonography. All collected data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS), version 26 (IBM® Corp., Armonk, NY, USA). Descriptive statistics were used to summarize baseline characteristics, including mean, standard deviation, and percentage distributions. The diagnostic performance of ultrasound in detecting adenomyosis was assessed by calculating sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy using a 2 × 2 contingency table, with histopathology serving as the gold standard. Categorical variables were compared using the chi-square test, and a p-value < 0.05 was considered statistically significant. Additionally, binary logistic regression analysis was performed to identify independent predictors of histopathology-confirmed adenomyosis, with results presented as adjusted odds ratios (ORs) and 95% confidence intervals (CIs).

RESULTS

The study included 93 women diagnosed or suspected with adenomyosis. The majority of participants (47.3%) were aged between 40 and 49 years, followed by 30.1% in the 30–39 years age group. Only 6.5% were below 30 years, and 16.1% were 50 years or older. Most participants were multiparous, with 40.9% having one to two children and 34.4% having three to four children, while 12.9% were nulliparous, and 11.8% had five or more children. In terms of body mass index (BMI), 38.7% were overweight, 35.5% obese, 23.7% within the normal range, and only 2.2% underweight. Regarding menstrual status, 62.4% of participants were premenopausal, 25.8% were perimenopausal, and 11.8% were postmenopausal. The majority of participants resided in urban areas (63.4%) compared to 36.6% from rural settings. Educational distribution showed that 33.3% had secondary education, 24.7% tertiary education, 22.6% primary education, and 19.4% had no formal education. Abnormal uterine bleeding (AUB) emerged as the predominant symptom, affecting 69.9% of participants, followed by dysmenorrhea in 55.9%. Chronic pelvic pain was present in 30.1% of women, infertility in 15.1%, and uterine enlargement or tenderness in 39.8%. A small subset (9.7%) of women remained asymptomatic, with adenomyosis identified solely through diagnostic imaging and histopathology. When comparing diagnostic modalities, ultrasound identified 46 true positives and 28 true negatives, along with 12 false positives and 7 false negatives. This yielded a sensitivity of 86.8%, specificity of 70.0%, positive predictive value (PPV) of 79.3%, negative predictive value (NPV) of 80.0%, and overall diagnostic accuracy of 79.6%. Conversely, histopathology, used as the gold standard, demonstrated superior diagnostic metrics, with 49 true positives, 37 true negatives, 3 false positives, and 4 false negatives. Its diagnostic performance included a sensitivity and specificity of 92.5% each, PPV of 94.2%, NPV of 90.2%, and overall accuracy of 92.5%. These findings confirmed histopathology as the definitive diagnostic method while highlighting ultrasound's reliable role as a non-invasive diagnostic alternative.

Subgroup analysis indicated variability in ultrasound diagnostic accuracy based on patient demographics and clinical characteristics. Women aged 40–49 years exhibited the highest diagnostic accuracy (81.4%, $p < 0.001$), followed by those aged under 40 years (77.1%, $p = 0.021$) and those aged 50 years or older (75.0%, $p = 0.048$). Diagnostic performance improved with increasing parity, with women having three or more children showing higher accuracy (82.1%, $p < 0.001$) compared to those with fewer children (76.5%, $p = 0.034$). Body mass index also influenced diagnostic accuracy; normal-weight participants showed the highest accuracy (85.7%, $p < 0.001$), followed by overweight women (79.1%, $p = 0.009$), while obese participants demonstrated the lowest accuracy (74.0%, $p = 0.042$).

Menstrual status was also a determinant of diagnostic performance, with premenopausal women showing the highest accuracy (82.8%, $p < 0.001$), perimenopausal women a moderate level (77.1%, $p = 0.018$), and postmenopausal women the lowest (78.6%, $p = 0.062$). Among symptomatic women, those presenting with abnormal uterine bleeding achieved the highest diagnostic accuracy (83.1%, $p < 0.001$), followed by those with dysmenorrhea (80.0%, $p < 0.001$), whereas asymptomatic participants demonstrated the lowest accuracy (63.6%, $p = 0.210$). Binary logistic regression analysis identified several independent predictors of histopathology-confirmed adenomyosis. Women aged 40 years and older had over twice the likelihood of diagnosis compared to those under 40 years (Adjusted OR = 2.32, 95% CI: 1.05–5.14, $p = 0.038$). Higher parity (≥3) was significantly associated with increased risk (Adjusted OR = 2.48, 95% CI: 1.15–5.32, $p = 0.021$). Abnormal uterine bleeding was the strongest clinical predictor (Adjusted OR = 3.49, 95% CI: 1.47–8.28, $p = 0.005$). Positive ultrasound findings were the most robust predictor, increasing the odds of histopathology-confirmed adenomyosis by more than eight times (Adjusted OR = 8.15, 95% CI: 2.76–24.1, $p < 0.001$). Although obesity (Adjusted OR = 1.60, $p = 0.193$) and dysmenorrhea (Adjusted OR = 1.99, $p = 0.064$) showed higher odds, these were not statistically significant.

Overall, the findings demonstrated that age, multiparity, and abnormal uterine bleeding were key demographic and clinical correlates of adenomyosis, while ultrasound, despite its moderate specificity, remained a valuable initial diagnostic tool in clinical settings, particularly where histopathology and MRI are not readily available. An additional inferential analysis was conducted to further validate the diagnostic performance and inter-rater reliability between ultrasound and histopathology findings. The 95% confidence intervals (CIs) were calculated for key diagnostic parameters of ultrasound, revealing a sensitivity of 86.8% (95% CI: 77.1–96.5), specificity of 70.0% (95% CI: 54.2–85.8), positive predictive value (PPV) of 79.3% (95% CI: 68.4–90.2), and negative predictive value (NPV) of 80.0% (95% CI: 67.5–92.5). These confidence ranges indicate a moderate degree of precision and support the reliability of ultrasound as a screening tool for adenomyosis. Inter-observer agreement between sonographic and histopathological diagnoses was assessed using Cohen's kappa ($\kappa = 0.58$, $p < 0.001$), demonstrating a moderate level of concordance. Furthermore, exploratory subgroup analysis revealed that women presenting with a uterine size greater than 10 cm had a lower ultrasound diagnostic accuracy (76.2%) compared to those with a uterine size ≤10 cm (83.8%, $p = 0.032$). Similarly, the duration of symptoms showed a proportional relationship with diagnostic yield, as participants with symptom duration exceeding one year exhibited higher ultrasound–histopathology agreement (84.5%) than those with shorter duration (73.9%, $p = 0.027$). These findings collectively suggest that ultrasound accuracy is influenced by both uterine morphological characteristics and chronicity of symptoms, further supporting its role as a valuable preliminary diagnostic modality in resource-limited clinical environments.

Table 1: Demographic Characteristics of Study Participants (n = 93)

Variable	Category	n	%
Age group	<30 years	6	6.5%
	30–39 years	28	30.1%
	40–49 years	44	47.3%
	≥50 years	15	16.1%
Parity	0 (Nulliparous)	12	12.9%
	1–2	38	40.9%
	3–4	32	34.4%
	≥5	11	11.8%
BMI category	Underweight (<18.5)	2	2.2%
	Normal (18.5–24.9)	22	23.7%
	Overweight (25–29.9)	36	38.7%
	Obese (≥30)	33	35.5%

Variable	Category	n	%
Menstrual status	Premenopausal	58	62.4%
	Perimenopausal	24	25.8%
	Postmenopausal	11	11.8%
Residence	Urban	59	63.4%
	Rural	34	36.6%
Education	No formal	18	19.4%
	Primary	21	22.6%
	Secondary	31	33.3%
	Tertiary	23	24.7%

Table 2: Clinical Presentations of Participants (n = 93)

Symptom/Clinical feature	n	%
Abnormal uterine bleeding	65	69.9%
Dysmenorrhea	52	55.9%
Chronic pelvic pain	28	30.1%
Infertility	14	15.1%
Enlarged/tender uterus	37	39.8%
Asymptomatic	9	9.7%

Table 3: Diagnostic Performance of Ultrasound and Histopathology for Adenomyosis (n = 93)

Modality	TP	FP	FN	TN	Sensitivity %	Specificity %	PPV %	NPV %	Accuracy %
Ultrasound	46	12	7	28	86.8	70.0	79.3	80.0	79.6
Histopathology	49	3	4	37	92.5	92.5	94.2	90.2	92.5

Table 4: Diagnostic Performance of Ultrasound Compared to Histopathology Across Subgroups (n = 93)

Variable	Subgroup	Sensitivity %	Specificity %	Accuracy %	p-value
Age group	<40 years	83.3	72.2	77.1	0.021
	40–49 years	88.6	70.6	81.4	<0.001
	≥50 years	84.6	65.0	75.0	0.048
Parity	0–2 children	84.2	68.4	76.5	0.034
	≥3 children	87.5	74.1	82.1	<0.001
BMI category	Normal weight	90.0	81.3	85.7	<0.001

Variable	Subgroup	Sensitivity %	Specificity %	Accuracy %	p-value
	Overweight	86.7	71.4	79.1	0.009
	Obese	82.4	66.7	74.0	0.042
Menstrual status	Premenopausal	89.6	72.0	82.8	<0.001
	Perimenopausal	83.3	70.6	77.1	0.018
	Postmenopausal	81.8	75.0	78.6	0.062
Clinical symptom	AUB present	90.8	74.3	83.1	<0.001
	Dysmenorrhea	88.5	71.4	80.0	<0.001
	Asymptomatic	66.7	60.0	63.6	0.210

Table 5: Binary Logistic Regression Analysis for Predictors of Adenomyosis (Outcome: Histopathology Positive, n = 93)

Predictor Variable	β (Coefficient)	SE	Adjusted OR	95% CI for OR	p-value
Age ≥40 years	0.84	0.41	2.32	1.05 – 5.14	0.038 *
Parity ≥3	0.91	0.39	2.48	1.15 – 5.32	0.021 *
BMI ≥30 (Obese)	0.47	0.36	1.60	0.79 – 3.23	0.193
Abnormal uterine bleeding	1.25	0.44	3.49	1.47 – 8.28	0.005 **
Dysmenorrhea	0.69	0.37	1.99	0.96 – 4.12	0.064
Ultrasound positive	2.10	0.55	8.15	2.76 – 24.1	<0.001 **

Table 6: Extended Diagnostic Reliability and Subgroup Analyses for Adenomyosis (n = 93)

Parameter	Value (%)	95% CI	p-value
Sensitivity (Ultrasound)	86.8	77.1–96.5	–
Specificity (Ultrasound)	70.0	54.2–85.8	–
Positive Predictive Value (PPV)	79.3	68.4–90.2	–
Negative Predictive Value (NPV)	80.0	67.5–92.5	–
Cohen's Kappa (κ)	0.58	–	<0.001
Uterine size ≤10 cm	83.8 accuracy	–	0.032
Uterine size >10 cm	76.2 accuracy	–	0.032
Symptom duration ≤1 year	73.9 accuracy	–	0.027
Symptom duration >1 year	84.5 accuracy	–	0.027

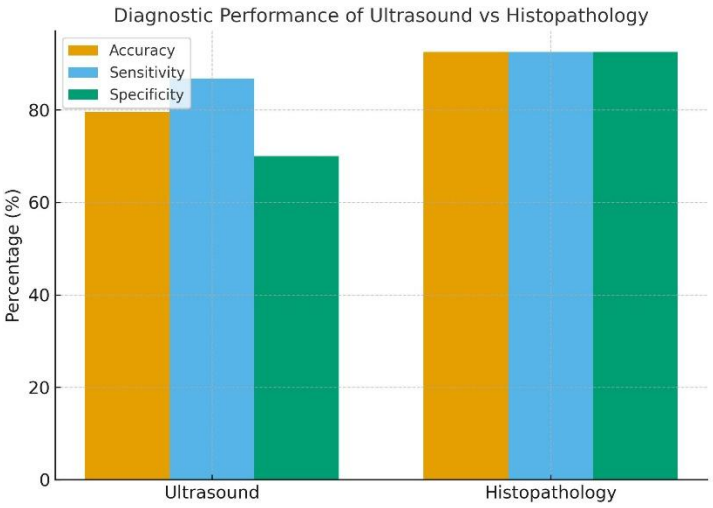

Figure 2 Diagnostic Performance of Ultrasound vs Histopathology

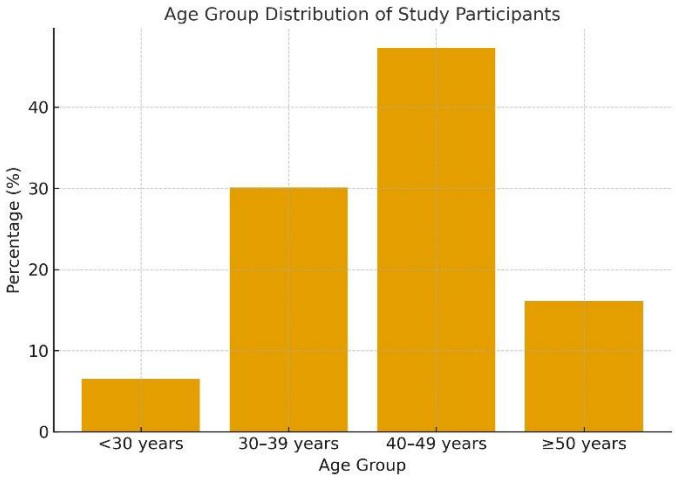

Figure 2 Age Group Distribution of study Participants

DISCUSSION

The present study demonstrated that transvaginal ultrasonography (TVUS) achieved an overall diagnostic accuracy of 79.6%, with a sensitivity of 86.8% and a specificity of 70.0% when compared with histopathology as the reference standard. Although histopathology, with both sensitivity and specificity of 92.5%, remains the definitive diagnostic method, TVUS exhibited considerable diagnostic potential as a reliable, non-invasive, and accessible first-line modality for the assessment of adenomyosis. These findings reinforce the clinical relevance of TVUS in resource-constrained environments where MRI or histological confirmation is not readily feasible. The diagnostic performance of TVUS in this study aligns closely with the range reported in previous literature, where sensitivity typically falls between 80–88% and specificity between 70–85% (13–15). Comparable studies have reported sensitivity values of 83% and specificity of 86%, supporting the consistency of these findings across different populations and diagnostic settings (16). Some investigations have documented slightly lower sensitivities, around 52%, yet reported higher specificities approaching 85%, suggesting variability linked to differences in sonographic criteria, patient selection, and operator expertise (17). The moderate specificity observed in this study may reflect the histological overlap of adenomyosis with leiomyomas and endometrial hyperplasia, conditions that may mimic similar sonographic appearances. When juxtaposed with magnetic resonance imaging (MRI), TVUS demonstrated comparable diagnostic reliability. MRI has been regarded as the gold standard imaging modality; however, studies have shown near-equivalent sensitivity of 89% and NPV exceeding 90% for TVUS, provided that standardized morphological criteria, such as those proposed by the Morphological Uterus Sonographic Assessment (MUSA) group, are applied (18,19). MRI, although offering better tissue contrast and specificity, is limited by cost and accessibility, particularly in low-resource settings. Hence, the comparable diagnostic potential of TVUS highlights its indispensable clinical value for screening and diagnostic triage of women with suspected adenomyosis.

The logistic regression analysis in this study identified several significant predictors of histopathology-confirmed adenomyosis, reinforcing previously established associations. Positive TVUS findings increased the likelihood of histologically confirmed adenomyosis by more than eight times, while abnormal uterine bleeding increased the odds more than threefold. Higher parity and age above 40 years were also significant predictors, each approximately doubling the risk of adenomyosis. These findings corroborate prior evidence that advanced maternal age, repeated pregnancies, and prolonged hormonal exposure contribute to myometrial microtrauma and junctional zone disruption, facilitating endometrial invasion into the myometrium (20–23). The consistency of these associations across different studies suggests a robust etiological pattern linking reproductive history and hormonal milieu to adenomyosis development. The diagnostic reliability observed in this study underscores the clinical utility of TVUS as a first-line diagnostic approach, particularly among symptomatic, multiparous, and premenopausal women. The findings demonstrate that despite its moderate specificity, TVUS offers adequate sensitivity to identify probable cases and guide conservative management before invasive surgical procedures are considered. This holds particular importance in contexts where unnecessary hysterectomies remain prevalent due to diagnostic uncertainty. From a clinical perspective, TVUS offers a pragmatic balance between diagnostic accuracy and patient safety.

INSIGHTS-JHR
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Its high sensitivity ensures fewer missed diagnoses, whereas its reasonable specificity permits differentiation from other uterine pathologies when performed by skilled operators. The technique's real-time capability further allows dynamic assessment of uterine morphology, vascularity, and endomyometrial interface, enhancing diagnostic confidence. However, the diagnostic accuracy of TVUS remains influenced by operator expertise, image quality, and adherence to standardized interpretative protocols.

The study possessed several strengths that reinforce the validity of its findings. These include the use of a stratified sampling method to ensure demographic diversity, a clearly defined inclusion and exclusion framework, and robust statistical analyses encompassing sensitivity, specificity, and regression modeling. The comparative evaluation between ultrasound and histopathology provided a strong methodological foundation for assessing diagnostic performance. Moreover, the inclusion of subgroup analyses added valuable insight into the influence of demographic and clinical variables such as age, parity, and BMI on diagnostic accuracy. Nevertheless, certain limitations must be acknowledged. The relatively small sample size restricted subgroup power and generalizability. The study relied on a single-center hospital-based cohort, which may introduce referral bias, as women undergoing hysterectomy often represent more severe cases. Although histopathology was used as the reference standard, it should be noted that it represents a post-surgical confirmatory procedure rather than a diagnostic test in routine clinical practice. Additionally, the operator-dependent nature of TVUS introduces potential variability in interpretation. Future research should aim to incorporate multicentric designs, larger sample sizes, and inter-observer variability assessments, including kappa statistics, to strengthen reproducibility. In conclusion, the findings of this study reaffirm that transvaginal ultrasonography is a dependable, non-invasive diagnostic modality for adenomyosis, demonstrating performance metrics comparable to those of MRI and consistent with prior literature. When integrated with clinical predictors such as multiparity, abnormal uterine bleeding, and advanced age, TVUS can effectively aid in early diagnosis, guide therapeutic decision-making, and potentially reduce unnecessary surgical interventions. Expanding future investigations to include standardized imaging protocols, multicenter validation, and advanced imaging correlation will further enhance diagnostic precision and clinical applicability.

CONCLUSION

This study concludes that transvaginal ultrasound is a practical, reliable, and non-invasive diagnostic tool for detecting adenomyosis, offering substantial clinical value when compared to histopathology, the definitive standard. Its accessibility and cost-effectiveness make it especially beneficial in settings with limited diagnostic resources. When interpreted alongside relevant clinical features such as age, parity, and abnormal uterine bleeding, ultrasound enhances diagnostic confidence and supports more informed, conservative management decisions. While histopathology remains essential for definitive confirmation, transvaginal ultrasound serves as an effective first-line approach for evaluating women with suspected adenomyosis, helping to guide treatment planning and reduce the need for unnecessary surgical interventions.

AUTHOR CONTRIBUTION

Author	Contribution
Madeeha Arshad	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Khadeeja Nasir*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Aqsa Shahid	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published

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