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Original Research Article

# Clinicopathological and ultra sonographic correlation in histologically confirmed cases of adenomyosis: A retrospective observational study

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## Abstract

**Background:** The prevalence of adenomyosis among patients who have had hysterectomies ranges from 8.8% to 61.5%. This wide range is due to the lack of definitive histopathologic criteria, variations in histologic tissue samples collected during hysterectomy, and differences in perception among healthcare providers. However, recent advancements in transvaginal ultrasound and MRI have made it possible to diagnose adenomyosis without surgery. Patients find transvaginal ultrasound tolerable, and it is also a cost-effective and widely available option. Continuous advancements in diagnostic methods have made it essential to conduct a detailed assessment of adenomyosis in the general population of women or in gynecology clinics based on ultrasound and histopathological findings.

**Aim & Objectives**: This retrospective observational study aims to determine the correlation between the clinical profile and ultrasound features of patients in histopathologically confirmed cases adenomyosis following hysterectomy.

**Materials and Methods**: This retrospective study analyzed patients with a histopathological diagnosis of adenomyosis who had undergone hysterectomy. Data was collected from medical records, including demographics, obstetric history, clinical presentations, ultrasound results, and histopathological findings. Preoperative transvaginal ultrasound (TVUS) results were assessed for key imaging characteristics of adenomyosis. The diagnosis was confirmed histologically by observing endometrial gland invasion into the myometrium of more than 2.5mm. Two independent reviewers handled data extraction, resolving discrepancies with expert input. The final dataset was securely stored and analyzed statistically for correlations between clinical, imaging, and pathological findings.

**Results:** The ultrasound findings of the uterus in patients with adenomyosis indicate that significant number of women had findings such as a diffuse scattered vascularity in the myometrium (24.4%) and anterior-posterior wall asymmetry (21.0%). The histopathological examination of the patients with adenomyosis revealed that 30.1% (37) participants had hyperplasia with atypia, and 24.4% (30) had benign pathology such as polyp, disordered proliferative endometrium, or hyperplasia without atypia. Only a minimal number of patients had high-grade endometrial adenocarcinoma 3.3% (4) and 1.6% (2) well-differentiated endometroid type endometrial carcinoma in their histopathological findings.

**Conclusion:** Our study determines the correlation among clinical characteristics, ultrasound results, and histopathological validation of adenomyosis. The enhanced precision of transvaginal ultrasonography in identifying adenomyosis before surgical intervention underscores its clinical significance. The findings support the notion that non-invasive diagnostic tools enhance early detection and inform management strategies.

**Keywords:** Adenomyosis, Clinical presentation, Hysterectomy, Histopathology, Transvaginal ultrasound.

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## 1. Introduction

Adenomyosis is the abnormal presence of endometrial glands and stroma deep inside the myometrium.[1] It was first described in 1860 by the German pathologist Carl von Rokitansky, who termed the histopathological finding "cystosarcoma adenoids uterinum".[2] Histologically, it is associated with hypertrophy or hyperplasia of the myometrial stroma, along with the presence of heterotopic endometrial glands and reactive fibrosis of the surrounding smooth muscle cells of the myometrium.[3] The pathology behind adenomyosis is poorly understood. Both human and

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experimental studies favour the theory of endomyometrial invagination of the endometrium, although the de-novo development of adenomyosis from Müllerian rests in an extrauterine location is a possibility.[1] One-third of the women affected by adenomyosis are asymptomatic, while others may present with abnormal uterine bleeding (AUB), dysmenorrhea, dyspareunia, or infertility. Additionally, adenomyosis, endometriosis, and leiomyoma commonly coexist in the same uterus, and differentiating the symptoms for each pathological process can be problematic. [4,5]

Previous studies on adenomyosis have primarily focused on women who have undergone hysterectomy, which may lead to an overestimation of its occurrence. As a result, there is limited published data on the prevalence of adenomyosis in both the general population of women and in patients with endometriosis.[5] The prevalence of adenomyosis among patients who have had hysterectomies ranges from 8.8% to 61.5%.[6] This wide range is due to the lack of definitive histopathologic criteria, variations in histologic tissue samples collected during hysterectomy, and differences in perception among healthcare providers.[7]

Previously, adenomyosis was mainly diagnosed through surgery, with hysterectomy being the main form of treatment.[8] However, advancements in transvaginal ultrasound and MRI have made it possible to diagnose adenomyosis without surgery.[9] These improved technologies have enhanced our ability to understand the structure of the uterus.[10] Both transvaginal ultrasound and MRI have shown high levels of accuracy in diagnosing adenomyosis before surgery.[11] Patients find transvaginal ultrasound tolerable, and it is also a cost-effective and widely available option.[11,12] Continuous advancements in diagnostic methods have made it essential to conduct a detailed assessment of adenomyosis in the general population of women or in gynecology clinics based on ultrasound and histopathological findings. The study aims to analyze the demographic and obstetric profile, clinical presentation, and transvaginal sonographic features of patients who underwent hysterectomy and to determine the correlation between the clinical profile and ultrasound features of patients in histopathologically confirmed cases of adenomyosis.

## 2. Materials and Methods

A retrospective observational study was conducted on middle-aged women who underwent hysterectomy and were diagnosed with adenomyosis through histopathological examination at a private medical college in Chengalpattu. Participants were selected based on medical records from the past six months, between November 2023 and May 2024. This study explored the demographic characteristics, clinical presentations, ultrasound findings, and histopathological features of patients with adenomyosis.

### *2.1. Sample size calculation*

In order to compute the sample size for the study, we conducted a thorough review of the literature and utilized the sample size formula for a single proportion. We established the proportion at 60%, the margin of error at 10% for a 95% confidence interval, and calculated the sample size for this study to be 93. To account for non-responsiveness, we added 30% to the study sample, resulting in a final sample size of 123. This study employed a purposive sampling method for recruiting patients.

### *2.2. Ethical approval*

The Institutional Ethics Committee of SRM Medical College Hospital and Research Center unequivocally granted ethical clearance for conducting the study.

### *2.3. Data collection process*

This retrospective study aimed to examine the demographic and obstetric profiles, clinical symptoms, and ultrasound findings of patients who had a hysterectomy and were diagnosed with adenomyosis. Data were meticulously gathered from the institution's medical records and pathology archives, with ethical approval obtained from the institutional review board. The criteria for inclusion were women who had histopathological confirmation of adenomyosis in the hysterectomy specimen and the availability of complete medical records, including preoperative ultrasound reports, demographic information, clinical symptoms, and obstetric history. Patients with incomplete records or those who had a hysterectomy for reasons not related to adenomyosis (such as uterine prolapse) were excluded from this study.

Data were gathered using a structured data collection form to ensure consistency and thoroughness. The variables consist of the patient's demographic and obstetric characteristics, including age at the time of hysterectomy, parity, and obstetric history, such as the number of pregnancies and delivery methods. Records were reviewed for any previous uterine surgeries (like cesarean sections or dilation and curettage) along with menstrual history, which includes age at menarche and menopausal status. Other clinical information, such as chief presenting symptoms, included heavy menstrual bleeding (HMB), dysmenorrhea, chronic pelvic pain, dyspareunia, and other related issues, as well as the duration and intensity of these symptoms. Additionally, the history of any medical or hormonal treatments before surgery was noted, along with the presence of any comorbid conditions, such as endometriosis or fibroids.

Subsequently, preoperative transvaginal ultrasound (TVUS) findings were assessed, and significant imaging characteristics indicative of adenomyosis were noted. H&E-stained slides from hysterectomy specimens were inspected for histopathological analysis to verify the adenomyosis diagnosis. The pathological criteria for adenomyosis

comprised the observation of endometrial glands and stroma penetrating the myometrium, situated a minimum of 2.5 mm from the endometrial-myometrial junction. Additional histological characteristics such as hyperplasia, fibrosis, and inflammatory changes were also documented.

To maintain precision and uniformity, data extraction was carried out by two separate investigators. Differences were resolved through consensus or consulting with a senior pathologist and radiologist. A pilot test of the data collection form was performed on a small group of cases to refine the methodology further. All gathered data were stripped of identifiers to ensure patient confidentiality. The final dataset was recorded in an Excel sheet, and statistical analysis was performed by importing it into SPSS software V20 to determine relationships between clinical presentation, ultrasound findings, and histopathological diagnosis.

### *2.4. Data compilation and statistical analysis*

The data was entered and analyzed using SPSS V20. Descriptive statistics were calculated for the categorical variables, including tabulations with frequency and percentages, as well as bar and pie charts.

## 3. Results

This observational descriptive study included 180 patients who visited a Gynecological OPD in a tertiary care hospital in Chengalpattu with various complaints related to adenomyosis from November 2023 to May 2024, for a period of six months. Out of the initial 180 patients, 57 were excluded due to multiple reasons. Therefore, data was collected from 123 patients. **Table 1** shows the baseline demographic and general characteristics of the patients. Of the 123 patients, 94 (76.4%) were between 41 and 50 years old, followed by patients aged 51 and above. The majority of the patients, 99 (80.5%), were married, and 86 (69.9%) were residing in rural Urea. More than half of the patients, 79 (64.2%), were illiterate. According to BG Prasad's classification based on per capita income, most of them, 70 (56.9%), had a socio-economic status of class II. During their medical history interviews, most of the patients reported having diabetes mellitus, followed by hypertension and other comorbidities.

**Table 2** provides information on the menstrual, obstetric, and gynecological characteristics of the participants. When asked about their current menstrual status, the majority of the 79 (64.2%) participants reported that they were still menstruating, and most of them,72 (58.5%) had heavy flow and only a few, 26 (21.1%), experienced normal flow. Most of the patients, 105 (85.4%), were in low multiparity, followed by 12 (9.8%) in grand multiparity. When asked about the mode of delivery, a significant number of them, 80 (65.0%), had experienced normal vaginal delivery followed by C-section delivery. Among the women who underwent C-sections, 37 (30.1%) had undergone the procedure twice or more. A large number of them, 81 (65.9%), had undergone sterilization. Of the surveyed women, 14 (11.4%) had undergone more than two abortions, and 6 (4.9%) had undergone suction and evacuation more than twice. The past surgical history of the abdomen revealed that 9.8% (12) of the participants had undergone abdominal surgery. Out of 123, 5(4.1%) had HRT for more than 12 months duration.

During the study, a total of 123 patients were observed. Out of these, 72 patients (58.5%) presented with abnormal uterine bleeding (AUB), 22 patients (17.9%) reported post-menopausal bleeding, and 21 patients (17.1%) complained of dysmenorrhea. The remaining patients reported other presenting complaints, such as pelvic pain (12 patients, 9.8%), mass descending per vagina (11 patients, 8.9%), infertility (8 patients, 6.5%) and mass abdomen (6 patients, 4.9%). A small number of patients (7 patients, 5.7%) had multiple complaints, such as dyspareunia, amenorrhea, and oligomenorrhoea. The details of presenting complaints were shown in the **Table 3**.

**Table 1:** Baseline demographic and general characteristics of patients

| S. No. | Characteristics | n (%) |
|---|---|---|
| 1. | **Age in groups** | |
| | 41 to 50 years | 94 (76.4%) |
| | 51 to 60 years | 19 (15.4%) |
| | 61 years and above | 10 (8.1%) |
| 2. | **Marital status** | |
| | Married | 99 (80.5%) |
| | Unmarried | 7 (5.7%) |
| | Widow | 17 (13.8%) |
| 3. | **Type of residence** | |
| | Rural | 86 (69.9%) |
| | Urban | 37 (30.1%) |
| 4. | **Educational status** | |
| | Literate | 44 (35.8%) |
| | Illiterate | 79 (64.2%) |
| 5. | **Socio economic status (Modified BG Prasad classification)** | |
| | Class I | 4 (3.3%) |
| | Class II | 70 (56.9%) |
| | Class III | 41 (33.3%) |
| | Class IV | 8 (6.5%) |
| 6. | **Co-morbidities** | |
| | Diabetes Mellitus | 20 (16.3%) |
| | Hypertension | 9 (7.3%) |
| | Both | 13 (10.5%) |
| | None | 81 (65.9%) |

**Table 2:** Baseline menstrual, obstetric and gynecological related characteristics of patients

| S. No | Characteristics | n (%) |
|---|---|---|
| 1. | **Current menstrual status** | |
| | Reproductive | 79 (64.2%) |
| | Peri menopause | 4 (3.3%) |
| | Post menopause | 40 (32.5%) |
| 2. | **Menstrual flow volume** | |
| | Normal flow | 26 (21.1%) |
| | Heavy flow | 72 (58.5%) |
| | Light flow | 3 (2.4%) |
| | Post-menopausal bleeding | 22 (18.0%) |
| 3. | **Parity** | |
| | Nulliparity | 6 (4.9%) |
| | Low multiparity | 105 (85.4%) |
| | Grand multiparity | 12(9.8%) |
| 4. | **Mode of delivery** | |
| | Normal vaginal delivery | 80 (65.0%) |
| | C-section delivery | 37 (30.1%) |
| | None | 6 (4.9%) |
| 5. | **No. of times undergone LSCS** | |
| | 1 time | 6 (4.9%) |
| | ≥ 2 times | 31 (25.2%) |
| 6. | **Sterilization done** | |
| | Yes | 81 (65.9%) |
| | No | 42 (34.1%) |
| 7. | **Abortion status** | |
| | None | 91 (74.0%) |
| | 1 abortion | 18 (14.6%) |
| | >1 abortions | 14 (11.4%) |
| 8. | **No. of times undergone suction and evacuation** | |
| | None | 103 (83.7%) |
| | 1 time | 14 (11.4%) |
| | ≥ 2 times | 6 (4.9%) |
| 9. | **Previous surgical history of abdomen** | |
| | Yes | 12 (9.8%) |
| | No | 111 (90.2%) |
| 10. | **Duration of HRT** | |
| | < 6 months | 3 (2.4%) |
| | 6 – 12 months | 3 (2.4%) |
| | > 12 months | 5 (4.1%) |

In **Figure 1**, we can see the duration of symptoms experienced by patients diagnosed with adenomyosis. According to the data, 46(37.4%) of patients had symptoms lasting six months to one year. However, a significant number of patients, 26(21.4%), had symptoms lasting more than one year.

**Figure 2** discloses the ultrasound findings of the uterus in patients with adenomyosis. The results indicate that 38(30.9%), had normal findings in their uterus. However, a significant number of women had findings such as a diffuse scattered vascularity in the myometrium (24.4%) and anterior-posterior wall asymmetry (21.0%). A small number of women had ultrasound findings of posterior fibroid (7.3%), Endometrial-myometrial junctional zone thickening (3.3%), and myometrial cysts (3.3%).

The details of ultrasound adnexal findings are presented in **Figure 3**. According to the study, the majority of participants, 97(78%), had normal findings in their adnexa. However, a small number of patients had left ovarian cysts (7.3%), right Para tubal cysts (4.1%), hydro salpinx (3.3%), mucinous cysts (2.4%), right adnexal (2.4%), and left adnexal cysts (1.6%).

The **Table 4** provides an overview of the histopathological findings of patients with adenomyosis. Out of all the participants, nearly half, 40.6% (50) had adenomyosis with myoma uteri. Following that, 30.1% (37) participants had adenomyosis with endometrial hyperplasia, and 24.4% (30) had adenomyosis with endometrial polyp. Only a minimal number of patients, 3.3% (4) had adenomyosis with high-grade endometrial adenocarcinoma and 1.6% (2) had adenomyosis with well-differentiated endometroid type endometrial carcinoma in their histopathological findings.

**Table 3:** Presenting complaints of patients indicating ultrasound examination

| S. No. | Presenting complaints (n = 123) | n (%) |
|---|---|---|
| 1. | Abnormal uterine bleeding | 72 (58.5%) |
| 2. | Post-menopausal bleeding | 22 (18.0%) |
| 3. | Pelvic pain | 12 (9.8%) |
| 4. | Dysmenorrhea | 21 (17.1%) |
| 5. | Infertility | 8 (6.5%) |
| 6 | Mass abdomen | 6 (4.9%) |
| 7 | Mass descending per vagina | 11 (8.9%) |
| 8 | Others (Dyspareunia, amenorrhea, oligo menorrhea) | 7 (5.7%) |

**Table 4:** Histopathological findings of patients with adenomyosis

| S. No | Histopathological findings | n (%) |
|---|---|---|
| 1. | Adenomyosis + myoma uteri | 50 (40.6%) |
| 2. | Adenomyosis + endometrial polyp | 30 (24.4%) |
| 3. | Adenomyosis + endometrial Hyperplasia | 37 (30.1%) |
| 4. | Adenomyosis + high grade endometrial adenocarcinoma | 4 (3.3%) |
| 5. | Adenomyosis + endometriod type endometrial carcinoma | 2 (1.6%) |

Significant correlations between specific clinical features and sonographic markers of adenomyosis were identified in the study population (n = 123) through Spearman correlation analysis. **(Table 5)** The myometrium's diffuse scattered vascularity was most strongly correlated with dysmenorrhea (r = 0.48, p < 0.01), followed by anterior wall asymmetry (r = 0.41, p = 0.01) and posterior or multiple fibroids (r = 0.36, p = 0.01). It was also significantly correlated with myometrial cysts (r = 0.29, p = 0.02) and endometrial-myometrial junctional zone thickening (r = 0.32, p = 0.02). The Junctional zone thickening (r = 0.39, p < 0.01), diffuse vascularity (r = 0.31, p = 0.02), and posterior fibroids (r = 0.33, p = 0.01) were all significantly correlated with abnormal uterine bleeding. Pelvic pain exhibited substantial correlations with diffuse vascularity (r = 0.46, p = 0.01), anterior wall asymmetry (r = 0.38, p = 0.01), junctional zone thickening (r = 0.34, p = 0.01), and posterior fibroids (r = 0.37, p = 0.01). The junctional zone thickening was weakly correlated with dyspareunia (r = 0.26, p = 0.04), while other associations did not reach statistical significance. Infertility was found to have a weak correlation with diffuse vascularity (r = 0.30, p = 0.02) and posterior fibroids (r = 0.28, p = 0.03). However, associations with other features, such as junctional zone thickening and myometrial cysts, were not statistically significant.

**Table 5:** Correlation between clinical features and transvaginal findings of adenomyosis using spearman correlation analysis

| Clinical features (n = 123) | Diffuse scattered vascularity in the myometrium (ρ, p-value) | Anterior-posterior wall asymmetry (ρ, p-value) | Endometrial-myometrial junctional zone thickening (ρ, p-value) | Posterior or multiple fibroid (ρ, p-value) | Myometrial cyst (ρ, p-value) |
|---|---|---|---|---|---|
| Dysmenorrhea | 0.48, p < 0.01 | 0.41, p = 0.01 | 0.32, p = 0.02 | 0.36, p = 0.01 | 0.29, p = 0.02 |
| Abnormal uterine bleeding | 0.31, p = 0.02 | 0.27, p = 0.03 | 0.39, p = <0.01 | 0.33, p = 0.01 | 0.25, p = 0.05 |
| Pelvic Pain | 0.46, p < 0.01 | 0.38, p = 0.01 | 0.34, p = 0.01 | 0.37, p = 0.01 | 0.28, p = 0.03 |
| Dyspareunia | 0.22, p = 0.06 | 0.19, p = 0.08 | 0.26, p = 0.04 | 0.20, p = 0.08 | 0.17, p = 0.10 |
| Infertility | 0.30, p = 0.02 | 0.24, p = 0.05 | 0.21, p = 0.07 | 0.28, p = 0.03 | 0.20, p = 0.08 |

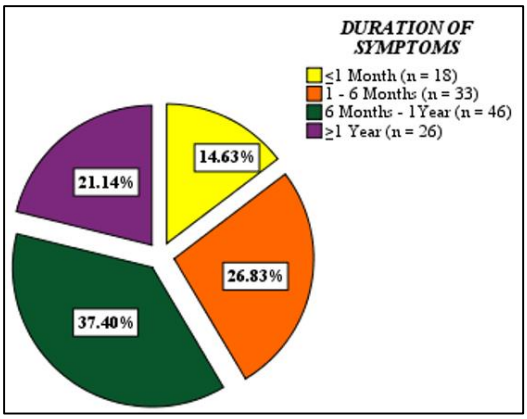


**Figure 1**: Duration of symptoms in patients with Adenomyosis

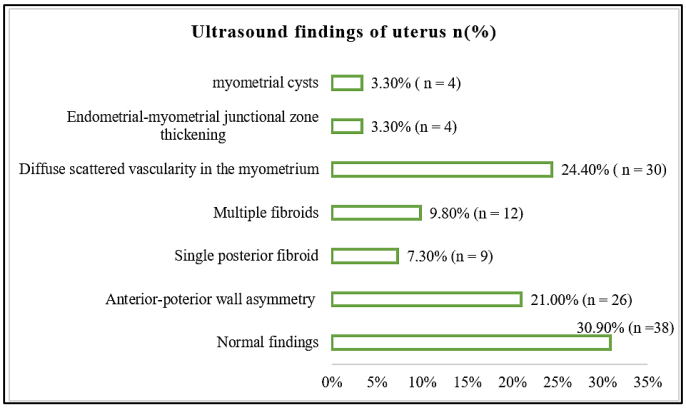


**Figure 2:** Ultrasound findings of uterus in patients with adenomyosis

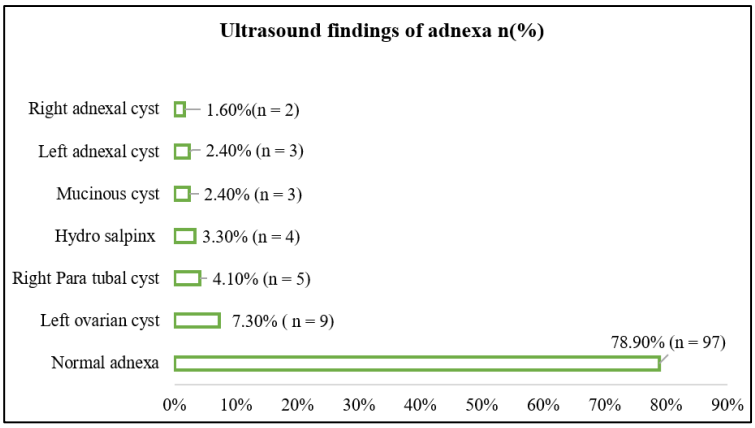


**Figure 3**: Ultrasound findings of adnexa in patients with adenomyosis

## 4. Discussion

Of the 123 patients, 94 (76.4%) were between 41 and 50 years old, followed by patients aged 51 and above. Similar to our study, a study done in Kerala by Gopinath et al. showed that 64% of people are 41 to 50.[9] Most of the patients, 99 (80.5%), were married, which is expected, and 86 (69.9%) were residing in rural area. More than half of the patients, 79 (64.2%), were illiterate. According to BG Prasad's classification based on per capita income, most of them, 70 (56.9%), had a socio-economic status of class II. During their medical history interviews, 34.1% of participants had comorbidities; most of the patients reported having diabetes mellitus, followed by hypertension and other comorbidities. However, according to the literature, no significant association existed between comorbidities and adenomyosis.

When asked about their current menstrual status, most of the 79 (64.2%) participants reported that they were still menstruating, and most had normal flow. However, only a few, 17 (13.9%), experienced heavy flow with pain. Naftalin et al. said in their study that 83% of participants were still menstruating.[10] Most patients, 105 (85.4%), had given birth to a low number of children, followed by 12 (9.8%) who had given birth to a high number of children. Soundarya et al. did a similar study in Chennai and stated that 5.7% of participants with adenomyosis were nulliparous, 2.9% gave birth to a higher number of children, and the remaining 91.4% of participants had a low number of children (p1, p2, p3).[3]

In this study, the mode of delivery was examined, with 80 (65.0%) of the participants experiencing normal vaginal delivery followed by C-section delivery. Among the women who underwent C-sections, 37 (30.1%) had the procedure twice or more. Parazzini et al. conducted a study in Italy and found that parous women and women reporting caesarean section had a higher frequency of adenomyosis.[13] 11.4% of the participants in this study had undergone more than two abortions, and 6 (4.9%) had undergone suction and evacuation more than twice. The risk ratio (RR) of adenomyosis was 1.9 in women reporting one or more induced abortions in the Parazzini study.[13] The past surgical history of the abdomen revealed that 9.8% (12) of the participants had undergone abdominal surgery.

The most common presenting complaint in this study was abnormal uterine bleeding (AUB), with 58.5% of participants experiencing it, followed by post-menopausal bleeding and dysmenorrhea, with 17% of participants presenting with these complaints. Other complaints included pelvic pain (9.8%), infertility (6.5%), mass abdomen (4.9%), and mass descending per vagina (8.9%). Soundarya et al. in their study noted that 74.3% of patients with adenomyosis had menorrhagia and 42.9% had dysmenorrhea.[3] Gopinath and Vaidya found similar results in their study, with AUB and dysmenorrhea being the most common presenting complaints.[9] Regarding the duration of symptoms, 46 (37.4%) of patients had symptoms lasting six months to one year in this study. However, a significant number of patients, 26 (21.4%), had symptoms lasting more than one year.

In this study, ultrasound findings revealed that 38 (30.9%) of the participants had normal findings in their uterus. Other findings such as a diffuse scattered vascularity in the myometrium (24.4%) and anterior-posterior wall asymmetry (21.0%), posterior fibroid (7.3%), Endometrial-myometrial junctional zone thickening (3.3%), and myometrial cysts (3.3%) were also observed. Another study found that adenomyosis patients also had other sonographic findings, including fibroids (22.8%), endometriosis (4.9%), polycystic ovaries (4.9%), and adnexal tumors (8.3%).[10] Regarding the adnexa, most participants 97(78%) had normal findings, while a small number of patients had left ovarian cysts (7.3%), right para tubal cysts (4.1%), hydrosalpinx (3.3%), mucinous cysts (2.4%), right adnexal (2.4%), and left adnexal cysts (1.6%). Another study associated endometrial hyperplasia with adenomyosis in 3.9% of women and endometrial polyp in 2.6%. Ovarian pathologies identified included simple ovarian cysts (2.6%) and serous cystadenoma (1.3%).[9]

Transvaginal ultrasound (TVUS) is considered the first-line imaging technique to diagnose adenomyosis due to its wide availability, relative affordability, and accuracy when

performed by expert sonographers.[14] Out of all the participants, 40.6% (50) had adenomyosis with myoma uteri. Following that, 30.1% (37) participants had adenomyosis with endometrial hyperplasia, and 24.4% (30) had adenomyosis with endometrial polyp. A minimal number of patients, 3.3% (4) had adenomyosis with high-grade endometrial adenocarcinoma and 1.6% (2) had adenomyosis with well-differentiated endometroid type endometrial carcinoma in their histopathological findings. In another survey, histopathological findings in subjects with adenomyosis included myoma uteri (46%), endometrial hyperplasia (12%), uterine prolapse (6%), adnexal mass (5%), and endometrial carcinoma (5%).[15]

Spearman correlation analysis revealed significant associations between clinical features and sonographic markers of adenomyosis. Myometrial vascularity is significantly correlated with dysmenorrhea ($r = 0.48$, $p < 0.01$), anterior wall asymmetry ($r = 0.41$, $p = 0.01$), posterior fibroids ($r = 0.36$, $p = 0.02$), endometrial-myometrial junctional zone thickening ($r = 0.32$, $p = 0.02$), and myometrial cysts ($r = 0.29$, $p = 0.02$). Abnormal uterine bleeding is significantly associated with junctional zone thickening, diffuse vascularity, and posterior fibroids ($r = 0.39$, $p < 0.01$). Diffuse vascularity, asymmetry of the anterior wall, and the presence of posterior fibroids are significantly associated with pelvic pain ($r = 0.46$, $p < 0.01$). Other associations were not significant except dyspareunia which exhibited a weak correlation with junctional zone thickening ($r = 0.26$, $p = 0.04$).

The strong association between dysmenorrhea and various adenomyosis markers in our study suggests that these imaging characteristics reflect the underlying pathophysiological alterations that contribute to menstrual pain. Also these findings suggest that the modified myometrial environment contributes for menstrual pain severity.[16] Ultrasound showing a thickened junctional zone indicates deep endometrial gland penetration and muscle hyperplasia, which may increase uterine contractility and prostaglandin release, worsening pain.[17] Myometrial cysts indicate ectopic endometrial glands that bleed or secrete in the myometrium, which may cause localised inflammation and uterine muscle fibre distension, causing dysmenorrhea. Diffuse intramyometrial vascularity, characterized by penetrating or scattered blood flow on Doppler imaging, correlates with dysmenorrhea, supporting the idea that adenomyosis increases uterine blood flow and congestion.[18] Hyper-vascularization may indicate active lesions that engorge during menstruation, increasing intrauterine pressure and pain. Our patients have a disproportionately thick anterior uterine wall, which is typical of adenomyosis, which enlarges one wall, usually the posterior. This asymmetry may disrupt uterine contractions and increase menstrual pain. The correlations suggest that dysmenorrhea is linked to ultrasound-detected adenomyosis changes like thickened junctional zone, cystic areas, asymmetric enlargement, and increased blood flow.[19] Previous studies have shown a positive correlation between ultrasound adenomyosis features and menstrual pain scores, supporting the idea that the cumulative burden of adenomyotic changes affects pain severity.[20] The findings show that each sonographic marker is a diagnostic indicator of adenomyosis.

## 5. Conclusion

Adenomyosis is a common gynecological condition seen in hysterectomy specimens. This study focuses on the relationship between clinical features, ultrasound findings, and histopathological confirmation of adenomyosis. The increasing accuracy of transvaginal ultrasonography in detecting adenomyosis prior to surgery highlights its clinical utility. These findings lend support to the idea that non-invasive diagnostic tools can improve early detection and inform management strategies. More research is needed to understand the natural history of adenomyosis and its relationship with infertility and other. This knowledge will be crucial in developing better preventive and treatment measures for women with adenomyosis.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

## 8. Ethical Approval

Ethical No.: SRMIEC- ST0325-2283.

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