

## Clinicopathological Analysis of Uterine Leiomyoma Variants in Hysterectomy Specimens: A Cross-Sectional Study

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**Abstract.** Uterine leiomyomas, commonly known as fibroids, are the most prevalent benign tumors of the female reproductive system, often presenting in women during their reproductive years. This study aimed to analyze the clinicopathological characteristics of various leiomyoma types in hysterectomy specimens. Conducted as a prospective, cross-sectional study at a tertiary care hospital over two years, the study included 403 cases of leiomyomas from a total of 680 hysterectomy specimens. Data on patient demographics, clinical symptoms, and histopathological findings were systematically collected and analyzed.

**Materials and Methods:** Specimens underwent gross examination and histopathological analysis to determine the type, location, and morphological characteristics of leiomyomas. Inclusion criteria were based on confirmed cases of leiomyomas in complete hysterectomy specimens, while cases with laparoscopically resected fibroids or incomplete specimens were excluded. Microscopic examination focused on cellularity, nuclear features, and mitotic activity to classify conventional leiomyomas and rarer variants.

**Results:** The study found that conventional leiomyomas were the most prevalent type (83.12%), followed by cellular leiomyomas (15.88%). Rare variants, including leiomyomas with bizarre nuclei, lymphocytic-rich leiomyomas, and mitotically active leiomyomas, constituted only 0.25% each. Most leiomyomas were intramural, and smaller tumors (<5 cm) were more common. Abdominal pain was the most frequently reported symptom, followed by abnormal uterine bleeding. Variants such as mitotically active leiomyomas and leiomyomas with bizarre nuclei presented histopathological challenges, highlighting the importance of accurate diagnosis to prevent overtreatment.

**Discussion:** The findings emphasize the impact of leiomyomas on women's health and underscore the need for detailed histopathological analysis to differentiate benign from potentially malignant variants. The age distribution, with a peak incidence in the 41-50 age range, aligns with hormonal influences on leiomyoma development. Understanding these variants informs treatment planning, allowing for tailored approaches that improve patient outcomes.

**Conclusion:** This study underscores the prevalence of conventional leiomyomas while highlighting the clinical significance of rare variants. Histopathological examination remains essential in distinguishing benign from

*malignant-like leiomyomas, guiding appropriate management. Further research into minimally invasive therapies and molecular insights could offer new diagnostic and treatment pathways for leiomyomas.*

**Keywords:** *Uterine leiomyoma, histopathology, leiomyoma variants, hysterectomy, conventional leiomyoma, cellular leiomyoma, mitotically active leiomyoma, women's health.*

## I. Introduction

Uterine leiomyomas, commonly known as fibroids, are the most prevalent benign tumors of the female reproductive system, primarily affecting women during their reproductive years. These smooth muscle tumors originate from the myometrium, the muscular layer of the uterus, and are estimated to occur in approximately 20% to 80% of women, with variations based on factors such as age, race, and genetics. While generally non-malignant, leiomyomas are significant due to their potential to affect women's reproductive health, quality of life, and overall well-being [1]. They can lead to a range of symptoms, including menorrhagia (heavy menstrual bleeding), pelvic pain, reproductive complications, and, in some cases, infertility. The impact of leiomyomas on women's health is profound, making them an important focus of clinical and pathological research to improve diagnostic accuracy and treatment strategies.

From a clinical perspective, the symptoms and health implications associated with uterine leiomyomas can vary widely. While some leiomyomas are asymptomatic and detected incidentally, others present with symptoms that severely affect patients' daily lives. Menstrual irregularities such as menorrhagia are common, often leading to anemia, fatigue, and reduced quality of life. Pelvic pain, discomfort during sexual intercourse, frequent urination, and constipation are other symptoms linked to the physical presence of the fibroids and their effect on surrounding organs [2]. Additionally, leiomyomas can complicate pregnancy by causing miscarriages, preterm births, or abnormal fetal positioning. This spectrum of symptoms emphasizes the importance of a comprehensive understanding of leiomyomas, especially in terms of their classification and morphological variants.

Uterine leiomyomas are not only a health concern for individual patients but also a broader public health issue. Given the prevalence of leiomyomas, particularly in women of African descent and those with a family history of fibroids, their treatment places a considerable burden on healthcare systems worldwide. Hysterectomy, the surgical removal of the uterus, remains one of the primary treatment options for leiomyomas, especially when conservative approaches are insufficient or inappropriate [3]. In the United States alone, it is estimated that up to 30% of hysterectomies performed on women under the age of 50 are due to fibroids. However, given the invasive nature of hysterectomy and its implications for fertility, research into alternative treatments has expanded, including medical and minimally invasive therapies. These alternatives are being explored to provide more options for patients seeking relief from symptoms while preserving their reproductive potential.

Besides the psychological and physiological implications of hysterectomy, leiomyomas' treatment costs are significant. Expenses related to direct medical care, time lost from work, and potential complications associated with untreated fibroids collectively represent an economic burden [4]. Thus, exploring various treatment modalities and refining diagnostic approaches are essential not only for patient care but also for mitigating healthcare costs. Moreover, understanding the distinct characteristics of leiomyomas—such as their size, location, growth rate, and variant types—is crucial for developing individualized treatment plans that can enhance clinical outcomes.

Leiomyomas exhibit a range of morphological patterns, and their classification based on these variants holds clinical importance. The histopathological examination of hysterectomy specimens reveals that while the majority of leiomyomas fall under the typical or "classical" category, there exist other variants with unique

structural and cellular characteristics. Conventional leiomyomas are characterized by well-organized bundles of smooth muscle cells with minimal atypia, limited mitotic activity, and a relatively low recurrence risk [5]. However, cellular variants, mitotically active variants, and those with atypical or bizarre nuclei may mimic more aggressive pathologies, such as leiomyosarcomas, and can present diagnostic challenges. Differentiating these variants is essential, as some can mimic malignant tumors, making accurate histopathological identification critical for prognosis and treatment planning.

Variants like cellular leiomyoma, which displays increased cellularity compared to conventional leiomyomas, require careful evaluation. Similarly, leiomyomas with bizarre nuclei, mitotically active leiomyomas, and lymphocytic-rich variants, though rare, are clinically significant. For instance, cellular leiomyomas, characterized by a higher density of cells with minimal atypia, can be mistaken for more aggressive stromal tumors. Mitotically active leiomyomas may exhibit increased mitotic figures, which could be confused with malignancy, necessitating differentiation from leiomyosarcomas [6]. Leiomyomas with bizarre nuclei contain atypical cells that raise concerns for malignancy due to their irregular nuclear shapes and sizes. Therefore, categorizing leiomyoma variants aids clinicians in identifying cases that may require closer monitoring or different therapeutic strategies, and it ensures that patients receive appropriate care based on the histological findings.

A range of diagnostic tools is available for identifying leiomyomas, including transvaginal ultrasound (TVU), magnetic resonance imaging (MRI), and, less commonly, hysterosalpingography. Each modality provides distinct insights into the size, location, and density of the fibroids [7]. Ultrasound is typically the first-line diagnostic tool due to its accessibility, cost-effectiveness, and ability to provide real-time imaging, making it particularly useful for identifying intramural and subserosal leiomyomas. MRI, on the other hand, offers superior soft-tissue contrast and can better differentiate between fibroid types, making it valuable for preoperative planning and for cases where malignancy is a concern [8]. While imaging techniques are essential for initial detection and treatment planning, definitive diagnosis relies on histopathological examination, particularly when assessing variant types with atypical features.

Variant analysis is essential due to the diverse presentation of leiomyomas and their potential to mimic malignancies. By classifying leiomyomas based on their morphological variants, pathologists can provide more accurate diagnoses that inform clinical decisions. Histopathological examination, through its focus on cellular architecture, mitotic activity, nuclear atypia, and cytoplasmic characteristics, allows for the differentiation of benign from potentially malignant variants. Identifying specific variants is critical as some leiomyomas may present with unusual characteristics that complicate diagnosis [9][10]. For example, leiomyomas with bizarre nuclei or those that are mitotically active may resemble leiomyosarcomas, a type of uterine cancer with a higher recurrence rate and a poorer prognosis. By carefully categorizing these variants, pathologists can reduce the likelihood of misdiagnosis and avoid unnecessary aggressive treatment.

Variant analysis also assists in predicting patient prognosis. Conventional leiomyomas generally have an excellent prognosis and a low likelihood of recurrence. However, certain rare variants, such as smooth muscle tumors of uncertain malignant potential (STUMP), present unique challenges. STUMPs, for instance, share characteristics with both benign leiomyomas and malignant leiomyosarcomas, making them difficult to classify definitively. These tumors may have a higher risk of recurrence, requiring more extensive follow-up and potential intervention. Variant analysis thus contributes to a more nuanced understanding of uterine leiomyomas and informs decisions on monitoring, surgical intervention, and postoperative management [11][12].

The clinicopathological study of uterine leiomyomas, with a focus on variant classification, is crucial for

advancing our understanding of these common yet complex tumors. Given the prevalence of leiomyomas and their impact on women's health, a comprehensive approach to diagnosis and management is necessary. By examining hysterectomy specimens and identifying morphological variants, pathologists can offer valuable insights that improve patient outcomes [13]. Additionally, this research underscores the importance of histopathological examination in distinguishing between benign and potentially malignant fibroids, ensuring that women receive precise and effective care tailored to their specific needs.

## II. Materials and Methods

This study was conducted to explore the histopathological features and variants of uterine leiomyomas in hysterectomy specimens. Conducted as a prospective, cross-sectional study in the Department of Pathology at a tertiary care hospital, this research spanned two years, from July 2022 to June 2024. By investigating the clinicopathological characteristics of uterine leiomyomas, we aimed to enhance diagnostic accuracy and therapeutic strategies. This section outlines the detailed methodology, inclusion and exclusion criteria, data collection procedures, and histopathological examination techniques utilized in the study.

### A. Study Design and Setting

This study employed a prospective, cross-sectional design to examine the morphological variants of uterine leiomyomas in hysterectomy specimens. The setting was a tertiary care hospital with access to various patient demographics, ensuring a diverse sample. The Department of Pathology was selected as the primary location for data analysis and examination of the specimens. All histopathological evaluations were conducted within this department, ensuring a standardized protocol for specimen processing, analysis, and diagnosis.

### B. Inclusion and Exclusion Criteria

#### a. Inclusion Criteria

The study included hysterectomy specimens obtained from patients diagnosed with uterine leiomyomas based on clinical and radiological assessments. Criteria for inclusion were as follows:

1. **Diagnosis of Leiomyomas:** Specimens from patients with a confirmed diagnosis of uterine leiomyomas were included. Diagnosis was based on clinical symptoms, imaging findings, and initial gross examination of the uterus.
2. **Age Range:** Specimens from women of any age were eligible, as leiomyomas affect women across reproductive and post-reproductive stages.
3. **Complete Hysterectomy Specimens:** Only cases where a complete hysterectomy was performed were included to allow for comprehensive analysis of the uterus and leiomyoma locations.

#### b. Exclusion Criteria

Certain specimens were excluded from the study to maintain consistency and focus:

1. **Laparoscopically Resected Specimens:** Cases where only myomas were resected laparoscopically without removing the entire uterus were excluded to ensure complete histopathological assessment.
2. **Incomplete Specimens:** Specimens that were damaged or had insufficient tissue for proper evaluation were excluded.
3. **Non-Leiomyoma Diagnoses:** Hysterectomy specimens with other primary pathologies unrelated to leiomyomas, such as endometrial carcinomas, were not included to focus on the target pathology.

### C. Data Collection Procedures

#### a. Patient Demographic Information

Patient demographics, including age, marital status, parity (number of pregnancies carried to a viable stage), presenting symptoms, and relevant medical history, were collected. These data were obtained from

histopathological requisition forms and clinical records provided with each specimen. Demographic details were anonymized and recorded to protect patient privacy.

#### b. Clinical Presentation

The clinical symptoms of each patient were noted, with particular attention to signs typically associated with leiomyomas, such as abnormal uterine bleeding (menorrhagia), pelvic pain, urinary frequency, and reproductive challenges. This information was essential for assessing symptom patterns relative to leiomyoma types.

#### c. Imaging and Preoperative Diagnosis

In most cases, preoperative imaging studies, including transvaginal ultrasound (TVU) or MRI, were available and reviewed to correlate imaging findings with histopathological observations. Ultrasound is frequently the initial imaging modality, providing real-time imaging for the assessment of leiomyoma size, location, and number, while MRI helps to determine soft-tissue characteristics that may suggest a particular variant.

#### d. Specimen Collection and Gross Examination

All specimens were obtained from the hospital's obstetrics and gynecology department. Upon receipt, hysterectomy specimens were immediately fixed in 10% buffered formalin for preservation. Each specimen underwent a detailed gross examination, with focus on identifying the location, number, and macroscopic characteristics of leiomyomas.

- **Weight and Size Measurements:** Each specimen was weighed, and the size of the uterus and any visible tumors was recorded.
- **Sectioning:** For gross examination, specimens were sliced at regular 1.0 cm intervals to inspect internal features accurately. For smaller leiomyomas (less than 10 cm), up to five representative sections were taken, while larger tumors (greater than 10 cm) required three sections of the largest nodule and additional sections from smaller nodules.
- **Nodule Examination:** Tumor nodules exhibiting atypical features, such as hemorrhage, necrosis, or softening, underwent more extensive sampling, with one section per cm of nodule up to 10 sections. These steps were followed to capture morphological diversity and ensure a thorough examination.

#### D. Histopathological Examination Methods

Histopathological processing of specimens adhered to standardized protocols for accurate assessment and consistency. The procedures included tissue dehydration, clearing, embedding, sectioning, and staining, with a focus on preparing high-quality samples for microscopic examination.

##### a. Tissue Processing

1. **Dehydration:** Specimens were dehydrated using ascending grades of alcohol, removing water content to prevent tissue shrinkage.
2. **Clearing in Xylene:** Specimens were cleared in xylene, which makes tissues translucent and prepares them for embedding.
3. **Embedding in Paraffin:** Tissues were embedded in paraffin to facilitate sectioning. This process stabilized the tissue structure, allowing for thin, uniform sections.

##### b. Sectioning and Staining

- **Microtome Sectioning:** Thin sections (3 to 5 microns) were cut using a rotary microtome. Uniform thickness ensured consistent microscopic examination across all samples.
- **Dewaxing and Staining:** Sections were dewaxed and stained with hematoxylin and eosin (H&E). Hematoxylin stained cell nuclei blue, while eosin provided a pink hue to cytoplasmic elements. This

staining method highlighted cellular and nuclear details necessary for differentiating leiomyoma variants.

c. Microscopic Examination

Microscopic examination focused on identifying specific histopathological features associated with leiomyoma variants:

1. **Cellular Organization:** Leiomyomas were examined for cellular architecture, such as fascicular or whorled patterns.
2. **Cell Shape and Nuclear Features:** Cell shape (spindle-shaped or elongated) and nuclear characteristics (cigar-shaped or atypical) were evaluated, as these features distinguish benign from atypical or potentially malignant forms.
3. **Mitotic Activity:** Mitotic figures were counted in 10 high-power fields (HPF). Leiomyomas with more than five mitotic figures per 10 HPF were classified as mitotically active, while those with fewer than five were considered typical.
4. **Atypia and Necrosis:** Cytological atypia and evidence of necrosis were noted, especially in rare variants. These features assist in identifying variants like bizarre nuclei leiomyoma and mitotically active leiomyoma.

E. Classification of Leiomyoma Variants

Based on the histopathological characteristics, leiomyomas were categorized into various types:

- **Conventional Leiomyoma:** Characterized by low cellularity, minimal mitotic activity, and elongated nuclei with a “cigar” shape.
- **Cellular Leiomyoma:** Higher cellularity than the surrounding myometrium, with uniformly bland cytomorphology and fewer than five mitotic figures per 10 HPF.
- **Leiomyoma with Bizarre Nuclei:** Presence of atypical cells with hyperchromatic, irregular nuclei, often with lower mitotic activity.
- **Mitotically Active Leiomyoma:** Displays increased mitotic figures (>5 per 10 HPF) but lacks necrosis or cytological atypia.
- **Other Rare Variants:** Included lymphocytic-rich leiomyomas and smooth muscle tumors of uncertain malignant potential (STUMP), which were identified based on specific histological markers.

F. Quality Control Measures

Throughout the study, strict adherence to quality control protocols ensured the reliability and accuracy of results:

1. **Protocol Consistency:** Each step of the specimen processing and histopathological analysis was conducted according to established guidelines.
2. **Inter-observer Verification:** All samples were evaluated independently by two pathologists to minimize subjective bias and ensure diagnostic accuracy.
3. **Standardized Equipment:** High-quality microtomes, staining equipment, and microscopes were employed to reduce technical variability.
4. **Documentation:** Detailed records were kept for each specimen, including demographic data, gross and microscopic findings, and histopathological diagnosis.

G. Data Analysis

Data collected from histopathological assessments, including demographic information, clinical presentations, and leiomyoma characteristics, were compiled and analyzed. Descriptive statistics were used to summarize frequencies, distributions, and associations of leiomyoma types with demographic factors. The analysis helped

to identify common patterns, age-specific trends, and the prevalence of different leiomyoma variants in the study population.

#### H. Ethical Considerations

The study adhered to ethical guidelines for research involving human tissue specimens. Consent was obtained for the use of hysterectomy specimens, and patient confidentiality was strictly maintained by anonymizing data. This comprehensive methodology enabled a detailed clinicopathological analysis of uterine leiomyoma variants in hysterectomy specimens, contributing valuable insights into the histomorphological features that inform clinical diagnosis and management. Through rigorous specimen processing, microscopic examination, and variant classification, this study highlights the importance of standardized protocols in understanding the spectrum of leiomyomas and providing tailored patient care.

#### III. Results

This section presents the findings on the prevalence, types, and morphological characteristics of leiomyomas observed in the study. Over the two-year study period, a total of 680 hysterectomy specimens were received, out of which 403 cases were confirmed as leiomyomas based on histopathological examination, accounting for 59.26% of all cases. Among these leiomyomas, different morphological types were identified, with conventional leiomyomas being the most prevalent, followed by several less common variants.



Figure 1: Gross specimen of pan hysterectomy showing a submucosal leiomyoma measuring approximately 8.6 cm in maximum diameter.

##### 1. Prevalence of Leiomyoma Types

A breakdown of leiomyoma types observed in the study is provided in Table 1. Out of 403 leiomyoma cases, conventional leiomyomas were predominant, comprising 83.12% (335 cases), while cellular leiomyomas represented 15.88% (64 cases). Rare variants, including leiomyomas with bizarre nuclei, lymphocytic-rich leiomyomas, mitotically active leiomyomas, and Smooth Muscle Tumors of Uncertain Malignant Potential (STUMP), each constituted 0.25% of the total cases.

Table 1: Distribution of Leiomyoma Types by Frequency and Percentage

Leiomyoma Variant	Cases	Percentage (%)
Conventional Leiomyoma	335	83.12
Cellular Leiomyoma	64	15.88
Leiomyoma with Bizarre Nuclei	1	0.25
Lymphocytic-Rich Leiomyoma	1	0.25
Mitotically Active Leiomyoma	1	0.25
STUMP (Smooth Muscle Tumor of Uncertain Malignant Potential)	1	0.25
<b>Total</b>	<b>403</b>	<b>100</b>

The distribution indicates that conventional leiomyomas are by far the most common type encountered in hysterectomy specimens, whereas other types occur infrequently. This prevalence is consistent with existing literature, underscoring the rarity of certain leiomyoma subtypes.

### 2. Age Distribution of Leiomyoma Cases

The age distribution of patients with leiomyomas is shown in Figure 1. The majority of cases (60%) were within the 41-50 age range, highlighting the typical prevalence of leiomyomas in women in their late reproductive to early menopausal years. The youngest patient in this study was 24 years old, while the oldest was 73, underscoring the range in age at which leiomyomas can present.

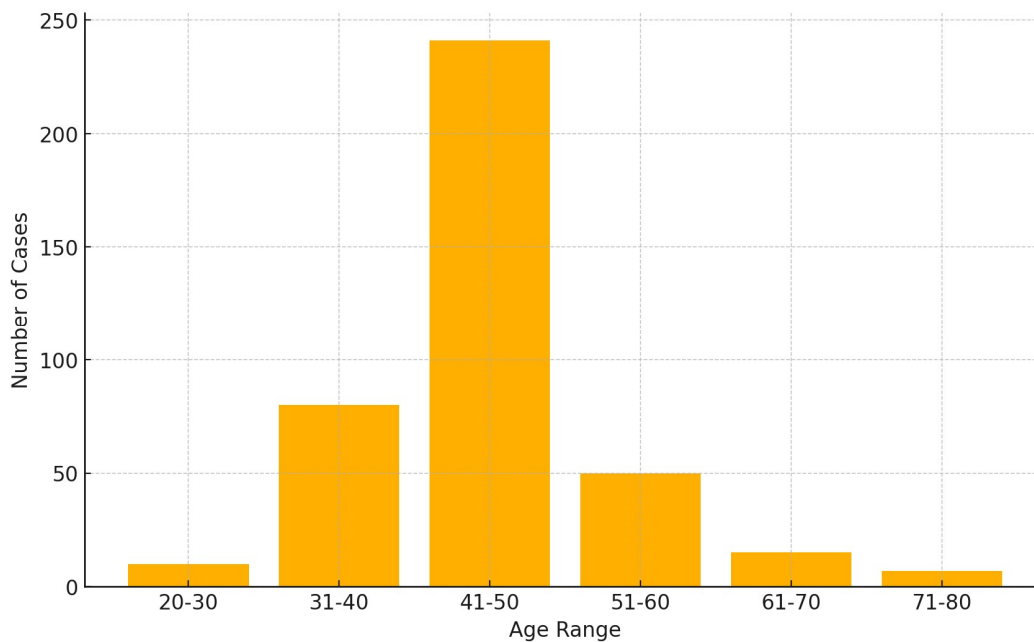


Figure 2: Age Distribution of Leiomyoma Cases

### 3. Clinical Symptoms Associated with Leiomyomas

Among the patients studied, the most common presenting symptom was abdominal pain, reported in 34.98% (141 cases). This was followed by per vaginal bleeding (PV bleed) in 23.32% (94 cases) and menorrhagia (heavy menstrual bleeding) in 20.84% (84 cases). Table 2 summarizes the primary symptoms observed.

Table 2: Distribution of Clinical Symptoms in Leiomyoma Cases

Symptom	Cases	Percentage (%)
Abdominal Pain	141	34.98

PV Bleed	94	23.32
Menorrhagia	84	20.84
Others (e.g., urinary frequency, reproductive issues)	84	20.86
<b>Total</b>	<b>403</b>	<b>100</b>

These findings emphasize the significant symptom burden associated with leiomyomas, particularly in cases where leiomyomas grow to a size or location that affects adjacent organs.

#### 4. Morphological Characteristics of Leiomyoma Variants

##### A. Conventional Leiomyoma

Conventional leiomyomas represented the largest group in this study, comprising 83.12% of cases. Gross examination revealed that conventional leiomyomas were firm, well-circumscribed, and had a characteristic whorled appearance on cut section. Microscopic examination showed smooth muscle cells arranged in a fascicular pattern with elongated, bland nuclei resembling cigars. Mitotic activity was low, typically less than 5 mitoses per 10 high-power fields (HPF).

##### B. Cellular Leiomyoma

Cellular leiomyomas were the second most common type, accounting for 15.88% of cases. These leiomyomas had a similar gross appearance to conventional leiomyomas but were distinguished microscopically by their higher cellularity. The cells appeared spindle-shaped with scant cytoplasm, and mitotic activity was low, below 5 mitoses per 10 HPF.

##### C. Rare Variants

Each of the following rare variants represented 0.25% of cases:

- **Leiomyoma with Bizarre Nuclei:** Characterized by cells with hyperchromatic, irregular nuclei. These cells were arranged in diffuse or whorled patterns, and mitotic activity was minimal.
- **Lymphocytic-Rich Leiomyoma:** This type exhibited a prominent infiltration of lymphocytes within the leiomyoma, adding an inflammatory component.
- **Mitotically Active Leiomyoma:** These leiomyomas showed higher mitotic figures ( $\geq 5$  mitoses per 10 HPF) but lacked atypia and necrosis.
- **STUMP:** Smooth Muscle Tumor of Uncertain Malignant Potential (STUMP) showed features between benign leiomyomas and malignant leiomyosarcomas, necessitating closer follow-up.

#### 5. Leiomyoma Location and Size Distribution

Most leiomyomas were intramural, accounting for 74.69% of cases. Other locations included subserosal (7.44%), submucosal (3.97%), and cervical (1.73%) areas. Additionally, mixed locations were noted, such as intramural with subserosal (10.92%). The distribution by location is illustrated in Table 3.

Table 3: Leiomyoma Location Distribution

Location	Cases	Percentage (%)
Intramural	301	74.69
Subserosal	30	7.44
Submucosal	16	3.97
Cervical	7	1.73
Mixed (Intramural + Subserosal)	44	10.92
<b>Total</b>	<b>403</b>	<b>100</b>

A histogram or pie chart could be used to illustrate the prevalence of leiomyoma locations, with intramural leiomyomas dominating.

In terms of size, smaller tumors (<5 cm) were more prevalent, observed in 54.59% (220 cases), while larger tumors (>5 cm) accounted for the remainder. Tumor size distribution is shown in Figure 2.

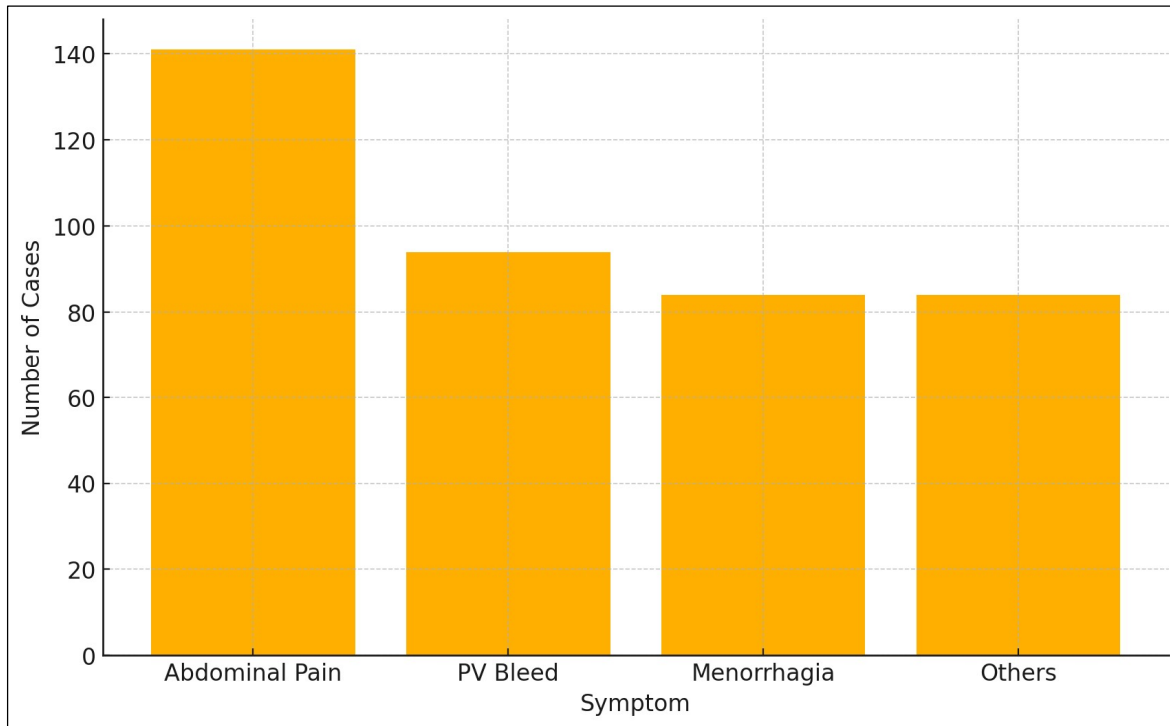
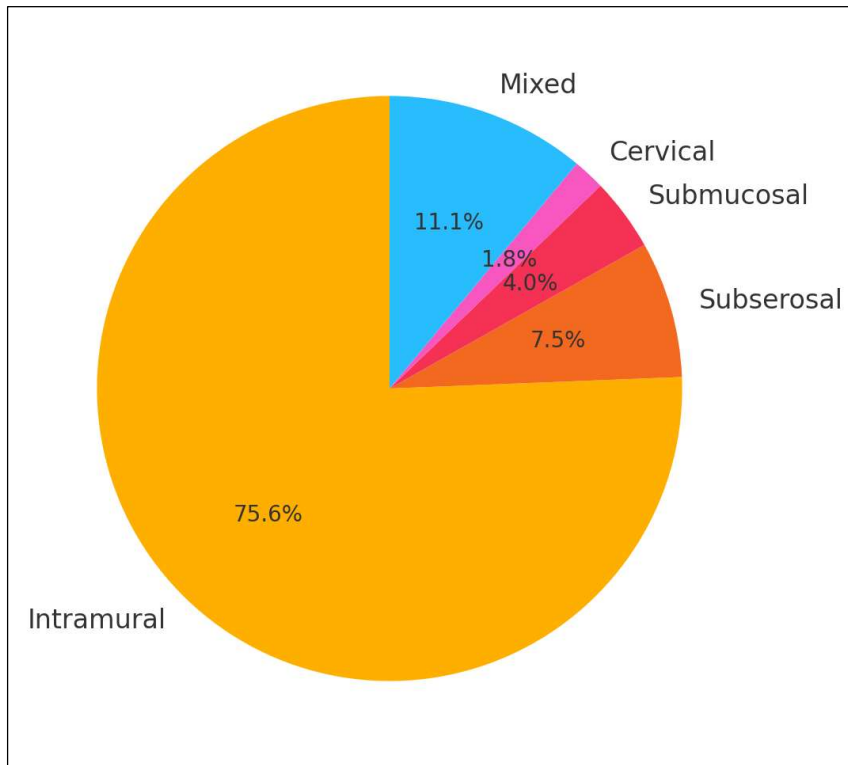


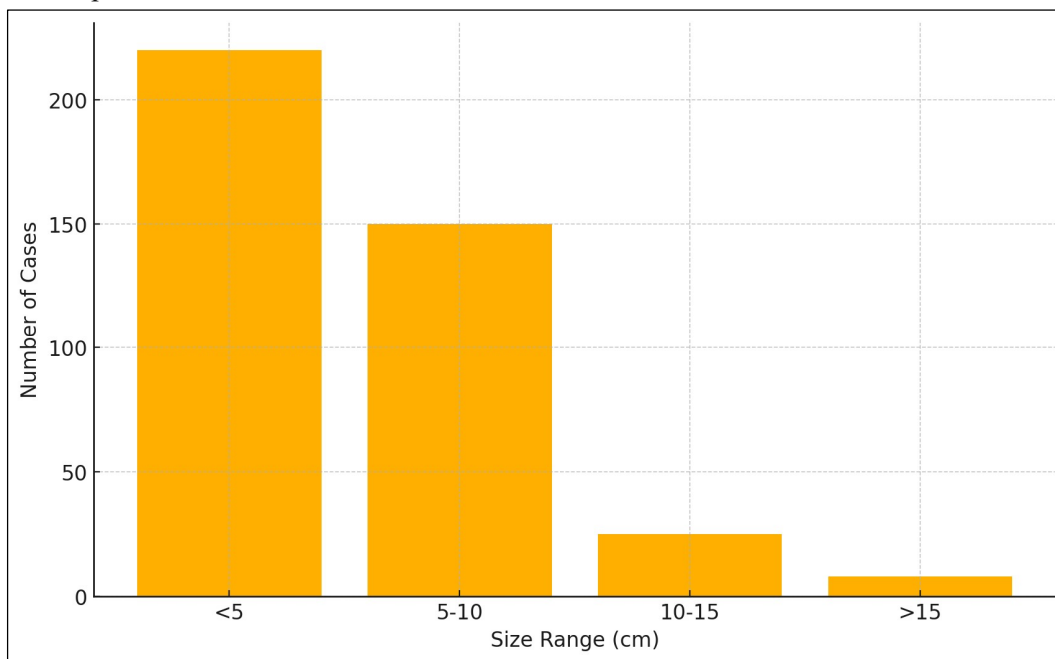
Figure 3: Tumor Size Distribution in Leiomyoma Cases

### 6. Microscopic Characteristics of Leiomyoma Variants

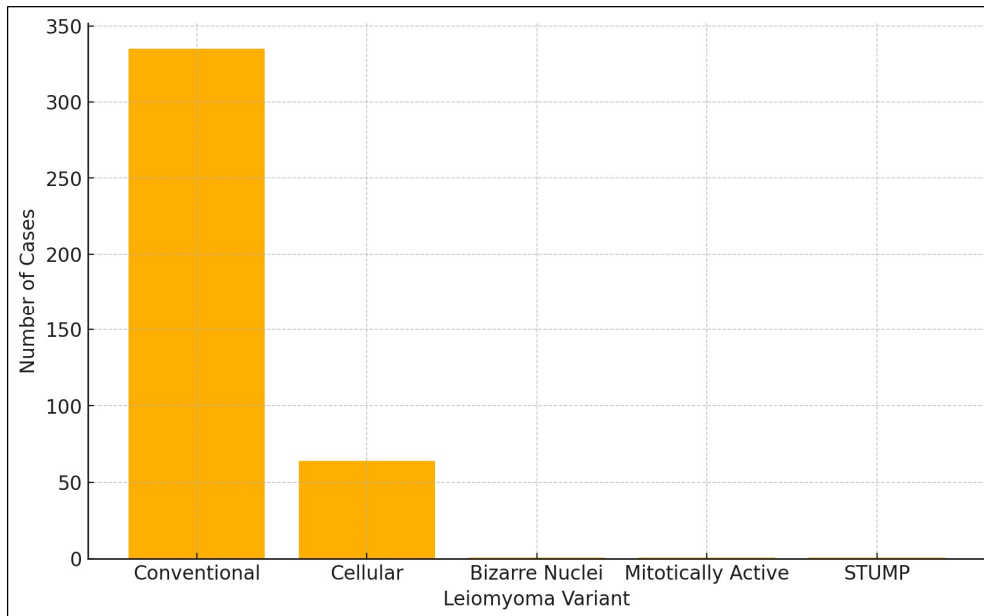
Photomicrographs illustrating the microscopic characteristics of various leiomyoma types are shown in Figures 3 through 5.



**Figure 4:** Conventional Leiomyoma – Smooth muscle cells in fascicular arrangement with bland, cigar-shaped nuclei.



**Figure 5:** Cellular Leiomyoma – Spindle cells with increased cellularity compared to conventional leiomyoma.



**Figure 6:** Leiomyoma with Bizarre Nuclei – Diffuse patterns with cells having hyperchromatic, irregular nuclei.

Each photomicrograph provides visual support for the histopathological features that differentiate these variants. The prevalence of leiomyoma types observed aligns with prior studies, where conventional leiomyomas are overwhelmingly the most common, while variants remain rare. The age and symptom data are also consistent with the typical demographic and clinical presentation of leiomyomas, with abdominal pain and abnormal bleeding being the most frequent symptoms.

Rare variants such as STUMP and mitotically active leiomyomas were noted to mimic malignancies, underscoring the importance of accurate histopathological diagnosis. The differentiation between benign leiomyomas and more aggressive tumors like leiomyosarcomas is critical for appropriate treatment planning and prognosis.

The findings emphasize the heterogeneity of leiomyomas in terms of type, location, size, and morphology. Intramural leiomyomas were the most common location, and conventional leiomyomas were the predominant type. Recognizing variant types, though rare, is clinically significant, especially in cases where they exhibit features that may be mistaken for malignancy. Through a combination of gross examination and microscopic analysis, the study contributes valuable insights into the diverse presentation of uterine leiomyomas, which may aid in future diagnostic and therapeutic approaches.

#### IV. Discussion

The study aimed to examine the clinicopathological characteristics of uterine leiomyomas and their morphological variants in hysterectomy specimens. The findings reveal important insights into the prevalence, age distribution, clinical symptoms, and histopathological features of leiomyomas, contributing valuable knowledge for improving diagnostic accuracy and therapeutic approaches in the management of this common gynecological condition.

##### a. Prevalence and Age Distribution

The majority of the leiomyomas observed in this study were classified as conventional leiomyomas, making up over 83% of the cases. This prevalence aligns with previous studies that indicate conventional leiomyomas are

the most common type, underscoring their benign nature and widespread occurrence in reproductive-age women. Most cases were identified in the 41-50 age range, consistent with literature suggesting that leiomyomas primarily affect women in their late reproductive to early menopausal years. This finding supports the hypothesis that hormonal factors play a significant role in the growth and development of leiomyomas, with estrogen and progesterone likely contributing to their proliferation.

**b. Symptomatology and Clinical Impact**

The clinical symptoms observed among the study participants—particularly abdominal pain, abnormal uterine bleeding, and menorrhagia—reflect the typical presentations of uterine leiomyomas. Abdominal pain was the most commonly reported symptom, followed by PV (per vaginal) bleeding and heavy menstrual bleeding, symptoms known to cause significant morbidity in affected individuals. These findings reinforce the understanding that leiomyomas, despite being benign, can have a considerable impact on quality of life due to pain, excessive bleeding, and other complications that may arise from their physical presence in the uterus.

Moreover, the high prevalence of these symptoms emphasizes the importance of timely diagnosis and intervention, as untreated leiomyomas can lead to more severe complications such as anemia from chronic blood loss or reproductive challenges due to their interference with normal uterine function.

**c. Morphological Variants and Their Clinical Relevance**

The study identified several histopathological variants of leiomyomas, each with distinctive characteristics that hold clinical significance. Conventional leiomyomas were found to be the most common and are typically benign, with low mitotic activity and minimal cellular atypia. Cellular leiomyomas, the second most frequent type, displayed increased cellularity, which can sometimes be misinterpreted as more aggressive lesions, emphasizing the importance of histological examination in preventing misdiagnosis.

Rare variants such as leiomyomas with bizarre nuclei, lymphocytic-rich leiomyomas, and mitotically active leiomyomas were observed infrequently, each representing only 0.25% of cases. These rare types are clinically significant as they may mimic malignant smooth muscle tumors, potentially leading to overtreatment if not accurately identified. For instance, leiomyomas with bizarre nuclei possess atypical cells that can resemble the nuclear atypia seen in leiomyosarcomas, a malignant form of smooth muscle tumor. Similarly, mitotically active leiomyomas with elevated mitotic counts may raise concerns for malignancy. However, the absence of necrosis and cytological atypia, as observed in this study, helps distinguish these benign variants from their malignant counterparts. This differentiation is essential as it guides the therapeutic approach and patient prognosis, sparing patients from unnecessary aggressive treatment.

STUMP (Smooth Muscle Tumor of Uncertain Malignant Potential) is a particularly challenging variant due to its ambiguous nature, displaying features that do not meet the full criteria for benign or malignant classification. Only one case of STUMP was identified in this study, reinforcing its rarity but also highlighting the importance of close follow-up, as these tumors can occasionally recur or progress. The identification of STUMP further emphasizes the value of variant classification and detailed histopathological examination in determining prognosis and tailoring patient management plans.

**d. Location and Size Distribution of Leiomyomas**

Most leiomyomas in this study were intramural, located within the muscular wall of the uterus. This intramural prevalence is consistent with established findings and suggests that leiomyomas often develop within the myometrium, where they can influence uterine function and structure, causing symptoms like pain and bleeding. The predominance of smaller leiomyomas (<5 cm) indicates that while leiomyomas can vary greatly in size, many remain manageable if diagnosed early. However, larger tumors are more likely to cause complications

due to their potential to compress surrounding structures, leading to symptoms such as urinary frequency or constipation.

The observed variation in size and location further supports the need for individualized treatment strategies, as the approach may differ depending on the tumor's size, location, and impact on the patient's symptoms.

#### e. Clinical Implications and Future Directions

The findings underscore the need for comprehensive histopathological analysis in the diagnosis of leiomyomas. Identifying specific variants not only aids in accurate diagnosis but also provides insights into the potential clinical behavior of these tumors. For instance, recognizing a mitotically active leiomyoma can help clinicians anticipate a more vigilant follow-up, even though the tumor is benign, to monitor any progression that may necessitate intervention.

Given the significant impact of leiomyomas on women's health, especially among those in their reproductive years, the study suggests a few future directions. First, there is a need for continued research on minimally invasive diagnostic methods and non-surgical treatment options, particularly for women seeking to preserve fertility. Advances in medical management, such as the use of hormone-modulating drugs, offer potential for symptom control while minimizing surgical intervention. Second, further studies focusing on the genetic and molecular basis of leiomyoma growth and variant formation may provide new insights into targeted therapies, which could improve outcomes and reduce the recurrence of these tumors.

### V. Conclusion

This study provides a detailed clinicopathological overview of uterine leiomyomas and their variants based on an analysis of hysterectomy specimens. Conventional leiomyomas were the most prevalent, accounting for the majority of cases, with rarer variants observed in only a small fraction of specimens. These findings align with the established understanding that while conventional leiomyomas are generally benign and straightforward to manage, certain rare variants—such as those with bizarre nuclei, increased mitotic activity, or inflammatory infiltration—pose unique diagnostic and clinical challenges due to their resemblance to malignant tumors. The study underscores the importance of histopathological examination in accurately diagnosing and differentiating these leiomyoma variants, which is critical for guiding appropriate clinical management. Identifying and classifying these variants help prevent overtreatment while ensuring close monitoring of cases with higher recurrence or potential malignancy risks. Furthermore, the distribution of leiomyoma types by patient age and location reinforces the role of hormonal and reproductive factors in leiomyoma development, particularly in the reproductive age group. The common clinical symptoms associated with leiomyomas, including abdominal pain, abnormal bleeding, and menorrhagia, emphasize the significant impact of these benign tumors on women's health and quality of life. This research advocates for continued investigation into non-invasive diagnostic and therapeutic methods, particularly for preserving fertility in younger patients. Additionally, exploring the genetic and molecular foundations of leiomyoma variants may open new avenues for targeted treatments. Overall, the findings support a tailored, variant-based approach to managing uterine leiomyomas, balancing effective symptom relief with minimally invasive options.

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