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Clinical and Ultrasonographic Profiling of Uterine Leiomyomas: A Cross-Sectional Study USG Profiling of Uterine Leiomyomas in Lucknow

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ABSTRACT

Objective: To identify the morphological changes present in uterus specifically associated with uterine fibroids within the population of Lucknow, and also to determine how these growths alter the overall morphology and morphometry of the uterus compared to healthy cases.
Method: The study included 205 adult female patients aged between 18 to 50 years, who underwent ultrasonography of the whole or lower abdomen or pelvic region. Out of which 100 (48.78%) were the control group and the other 105 (51.2%) were the affected group. The USG machine used is SAMSUNG HS50. The morphometry (length and width) and texture (heterogeneous hypoechoic and homogenous hypoechoic) of the uterine fibroids was recorded. Student t-test was used to compare mean between two age groups.
Results: The average age was about 30 years. In the 30-39 age group there are more numbers of patients were seen with uterine fibroids, which represents over half of all the diagnosed cases. In the affected group, approximately 33.3% presented with a bulky or enlarged uterus, while 66.7% keeps a normal uterine morphometry. Fibroids characterized as Heterogenous Hypoechoic appear much larger on average, measuring 20.1 mm as compared to the more uniform Homogenous Hypoechoic type, which has a mean length of just 9.8 mm.
Conclusion: One of the clearest findings is the strong link between age and the development of uterine fibroids, most generally diagnosed during the early reproductive times. Beside the presence of these growths, a substantial majority of the affected patients maintained a completely normal uterine size. This trend strongly suggests that as fibroids expand in size, they frequently undergo internal degenerative changes, such as necrosis.

Keywords*: uterine fibroid, leiomyoma, heterogenous hypoechoic, homogenous hypoechoic.*

INTRODUCTION

Uterine leiomyomas, commonly referred to as uterine fibroids, are the most prevalent benign tumors of the uterus and adjacent pelvic organ. They occur in 20 % to 50% of women.(1) Although they often develop early in life, they remain a leading cause of morbidity among women of reproductive age.(2) The uterus is a central organ in the female reproductive system, classically described as pear-shaped and measuring approximately 7.5 cm in length in a non-pregnant adult. The uterus is anatomically divided into four main parts: the fundus, the body, the isthmus, and the cervix. Usually, the organ is positioned in ante-flexion and ante-version, which causes it to be almost horizontal. However, variations in its position, such as retro-flexion and retroversion, are common, occurring in about a quarter of women.(5) Fibroids are scientifically

classified as monoclonal tumors that develop from the smooth muscle of the uterus.[3] They originate specifically from myometrial stem cells and possess a substantial extracellular matrix that is rich in components such as collagen, fibronectin, and proteoglycans. Hormonal dynamics play a crucial role in growth of the tumors.[4] Their development is closely associated with increased hormone levels, mainly high estradiol-to-progesterone ratio. Cellular division (mitotic activity) within the tumor tissue is strongly correlated with progesterone surges during the secretory phase of menstrual cycle. A detailed analysis of the size, number, and position of myomas enables the optimal selection of patients for various interventions, whether medical therapy, noninvasive procedures, or surgery. Ultrasonography (USG) is the primary and initial diagnostic tool to examine for the assessments. Both transabdominal and transvaginal scans are utilized to detect the accurate location of fibroids, with transvaginal ultrasound being highly sensitive for identifying leiomyomas as small as 5 mm.[1]

Clinical

Many women with uterine fibroids remain completely asymptomatic, regardless of the size of the myoma. However, when symptomatic, these tumors can cause a wide array of severe health issues. Clinical presentations often include abnormal bleeding, which can result in iron-deficiency anemia, as well as significant pelvic pressure leading to abdominal distension and pain. Additionally, fibroids can impact surrounding systems, causing gastrointestinal issues like constipation or urinary effects such as frequency and retention. Furthermore, they are linked to reproductive difficulties, including infertility and miscarriage.

MATERIALS AND METHODS

2.1. Subjects

This study was carried out at Integral University in the Department of Anatomy in association with the Department of Radiology after the clearance of Ethical committee
(ICE/IIMSR/2025/24).
The study included 205 adult patients aged between 18 to 50 years, who underwent ultrasonography of the whole abdomen, lower abdomen or pelvic region. Out of which 100 (48.78%) were in control patient group and the other 105 (51.2%) were in affected patients group.

Inclusion Criteria

- Women between the age of 18-50year
- Patient with symptom with menorrhagia
- A palpable mass in the abdomen or pelvis.

Exclusion Criteria

- Pregnant women, recent abdominal surgery
- presence of surgical scars

2.2. Measurements

The USG machine was used in USG is SAMSUNG HS50. Total 205 female patients were included in the present study and the patients taken in consideration for the study were the one who had visited the hospital for USG of abdominal or pelvic area. After the ultrasound was done and the report was generated, a copy of the report was obtained from the radiology department. Only those reports were considered which full filed the inclusion criteria.

The morphometry (length and width) and texture (heterogeneous hypoechoic and homogenous hypoechoic) of the uterine fibroids was recorded in the data collection form. Now the collected data was entered in data collection spreadsheet. Now after the completion of data entry, different statistical tests were performed on the data set for data analysis. The software used for data entry and analysis was MS Excel 2021. The images were also considered during analysis.

Descriptive statistics was used to present data in table, graph. Student t-test was used to compare mean between two graph $p<0.05$ will considered significant.

RESULTS

This chapter shows the findings from the USG evaluation of 205 women in Lucknow.

TABLE 01: Descriptive analysis of overall parameters

Parameters	Mean ± SD (mm)	Median	SE	Min-Max	Range	95% CL
Age (Years)	30.06±8.49	32	0.59	18 - 46	28	1.17
Fibroid Length (mm)	5.4±10.48	1	0.73	0 - 77	77	1.44
Fibroid Width (mm)	4.77±10.35	1.1	0.72	0 - 80	80	1.43

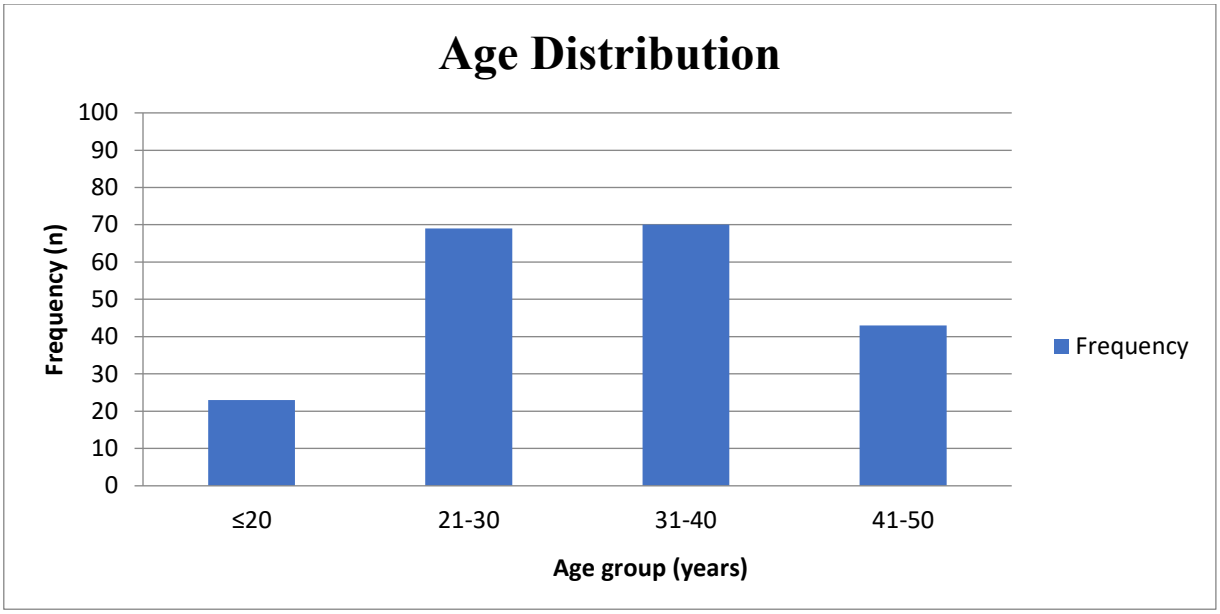

Figure 01: Age distribution graph

TABLE 02: Age-Related Prevalence of fibroids

Age Bracket	Control (No Fibroids)	Affected (With Fibroids)	Total Cases
< 30 Years	53	31	84
30-39 Years	15	53	68
40+ Years	32	21	53
Total	100	105	205

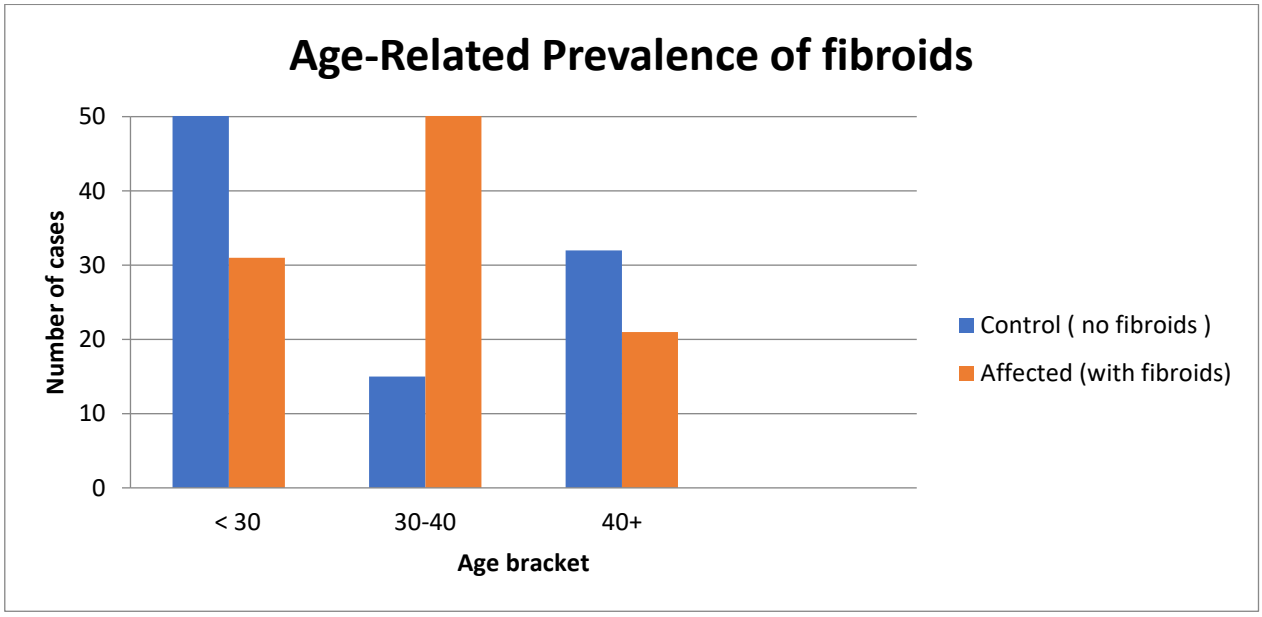

Figure 02: Graphical representation of age-related prevalence of fibroids

3.1. Age-Related Prevalence and Descriptive Statistics

In the study of 205 women, the average age was about 30 years, with participants ranging from 18 to 46. The data shows a clear peak occurring during the prime reproductive years. In this 30-39 age bracket, there are more numbers of patients seen with uterine fibroids, which represents over half of all the diagnosed cases. It can also be seen that after age of 40 years, the number of new cases appears to decline. While the average length and width were roughly 5 mm, the median length was only about 1 mm. A handful of patients have much larger growths, reaching up to 80 mm.

TABLE 3: Association between fibroid and uterine size using chi-square test

Diagnosis Group	Normal Uterus Size	Bulky / Enlarged Uterus	Total
Control (No Fibroids)	100	0	100

Affected (With Fibroids)	70	35	105
Total	170	35	205

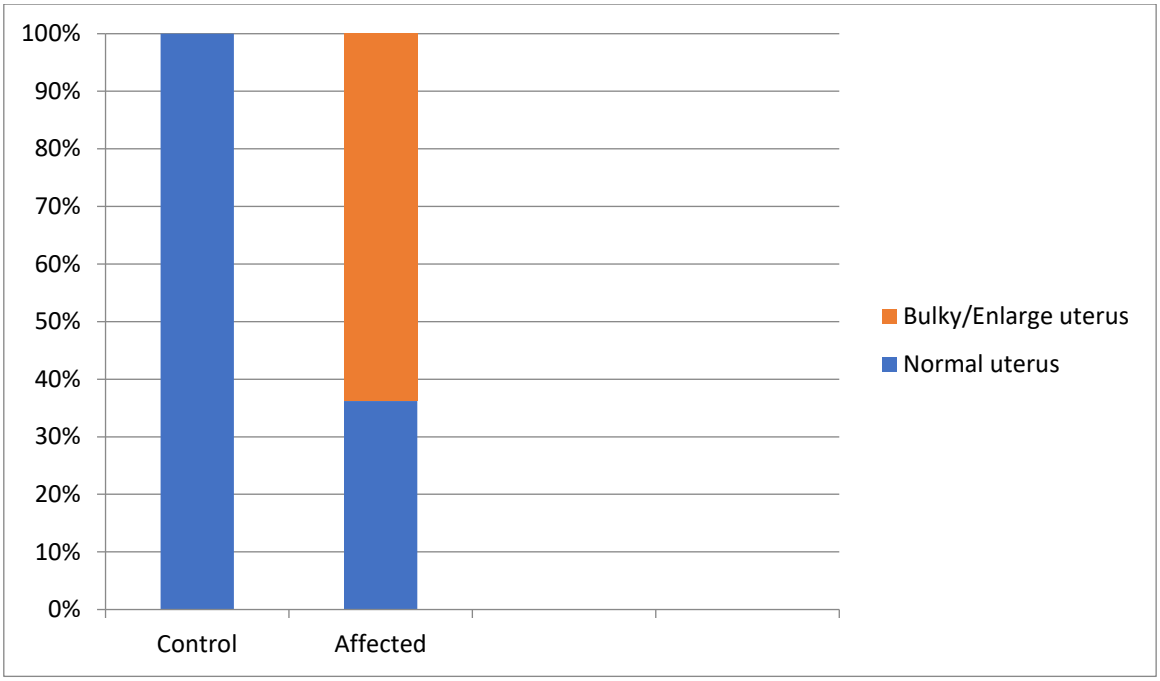

Figure 03: 100% stacked graphical representation of association between fibroid and uterine size

3.2. Uterine Morphometry and Sonographic Texture

In the control group (n=100), all subjects exhibited a normal uterine size (100%). In the affected group (n=105) approximately 33.3% i.e. 35 out of 105 patients presented with a bulky or enlarged uterus, while 66.7% i.e. 70 patients keeps a normal uterine morphometry. Fibroids characterized as Heterogenous Hypoechoic appear much larger on average, measuring 20.1 mm as compared to the more uniform Homogenous Hypoechoic type, which has a mean length of just 9.8 mm. The high standard deviation of 17.09 mm indicates that their sizes vary widely from patient to patient. With a p value of 0.0547, this trend shows borderline significance.

TABLE 04: Comparison of sonographic texture with uterine fibroid size using Student's T test

Sonographic Appearance	Sample Size (N)	Mean Length (mm)	Standard Deviation (SD)	t-value	p-value
Heterogenous Hypoechoic	13	20.1	17.09	2.100*	0.0547
Homogenous Hypoechoic	32	9.8	7.1		

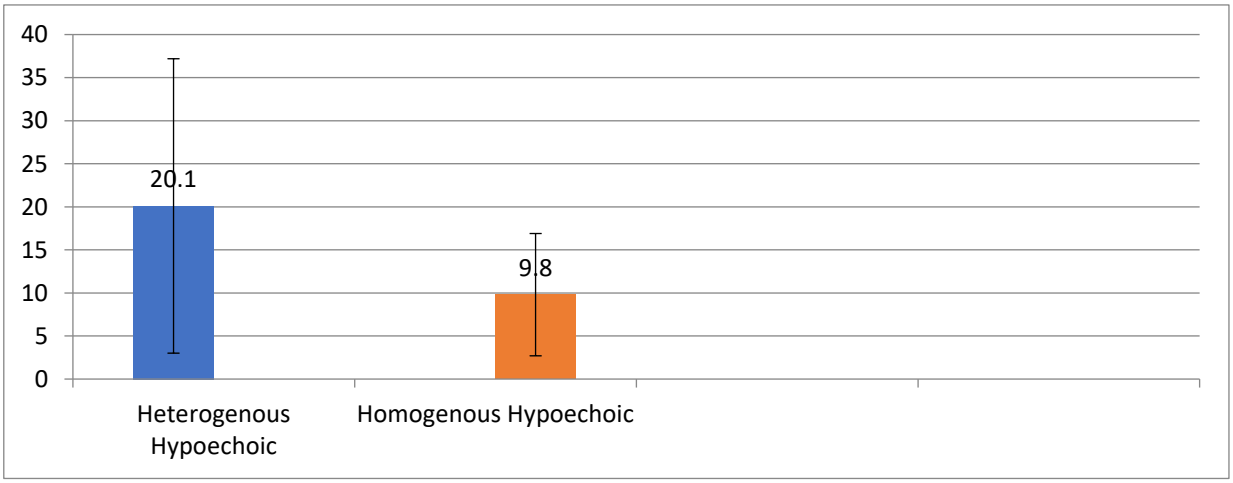

Figure 04: Graphical representation of comparison of mean length of Heterogenous Hypoechoic and Homogenous Hypoechoic uterine fibroids.

3.3. Comparison of sonographic texture with uterine fibroid size using student's T-test

The data represented in Table 04 and Figure 04 depicts a noticeable relation between the internal texture of a fibroid and its physical dimensions .Specifically, fibroids characterized as Heterogenous Hypoechoic appear much larger on average, measuring 20.1 mm as compared to the more uniform Homogenous Hypoechoic type, which has a mean length of just 9.8 mm. While the heterogenous group is significantly larger, the high standard deviation of 17.09 mm indicates that their sizes vary widely from patient to patient. With a p value of 0.0547, this trend shows borderline significance, indicating that as these fibroids increase in size, they tend to develop internal changes like necrosis or degeneration, which alters their sonographic texture

DISCUSSION

4.1. Age Dynamics and Fibroid Development

The study provides an important USG insight into the prevalence and characteristic of uterine fibroids among 205 patients. This study shows a very distinct relation between the appearance of uterine fibroids and patient's age. The data shows a clear peak occurring during the prime reproductive years. In this 30-39 age bracket, there are more numbers of patients seen with uterine fibroids, which represents over half of all the diagnosed cases. It was also found that once the patient reached forty years of age, the occurrence of the uterine fibroids began to decrease. KAWAGUCHI K et al 1989 investigated the role of the menstrual cycle in the growth of uterine leiomyomas and the relation of this to the patient's age (30 to 54 years). The younger age group exhibited significantly higher mitotic activity than the older patient group.

4.2. Uterine Morphometry

A distinctly important clinical takeaway appears from relation between presence of fibroids and overall size of uterus. Among the affected patient (105), 66.7% of them are maintaining normal morphometry of uterus, while only one third presenting enlarged uterus. Median length of fibroids are merely 1 mm, in spite of maximum size is reaching 80 mm. Depending solely on physical symptoms of uterine enlargement will likely miss a vast majority of early, asymptomatic fibroids. Woznaik a et al. 2017 found that ultrasound is the first line of imaging examination showing the high sensitivity and specificity. HANDA K et al. 2015 transvaginal sonography were found to be more accurate for the diagnosis of small fibroids.

4.3. Sonographic Texture as a Marker of Progression

This finding shows a direct relation between fibroids dimensions and its internal sonographic texture. This presenting a heterogenous hypoechoic effect were markedly bigger, with a mean length of 20.1 mm, contrast to the more similar, homogenous hypoechoic growths averaging just 9.8 mm. While the statistical significance here is border line ($p=0.0547$), it strongly indicates a biological reality: as these fibroids expand in size, they are increasingly prone to undergoing internal structural changes, such as necrosis or degeneration. The high variance in the heterogenous group further reflects the unpredictable nature of this degenerative process across different patients. EDZIE EKM et al. 2023 uterine fibroids are mostly heterogenous hypoechoic.

CONCLUSION

One of the clearest findings is the strong link between age and the development of uterine fibroids. The data shows that fibroids are most generally diagnosed during the early reproductive times, with the loftiest frequency seen among women aged 30 to 39. After the age of 40, the trend begins to decline, suggesting a shift in threat as women move beyond their peak reproductive times. This highlights the need for heightened sonographic monitoring and alert beginning around age 30. Secondly, the analysis dare the traditional clinical support on uterine enlargement as a primary indicator of these tumors. Beside the presence of these growths, a substantial majority of the affected patients (66.7%) maintained a completely normal uterine size . due the median fibroid length was nearly 1 mm, it is evident that most fibroids in this demographic are remarkably small. This show that only physical examinations are not enough, so for the better result high-resolution ultrasonography are very reliable. We observe that heterogenous hypoechoic fibroids were notable bigger in size, an averaging 20.1 mm, compared to the smaller, 9.8 mm homogenous types. With a borderline significant p-value of 0.0547, this trend strongly suggests that as fibroids expand in size, they frequently undergo internal degenerative changes, such as necrosis.

6. Limitations

While the study gives you valuable data of 205 women, there are certain limitations should be noted, such as 13 patients of heterogenous fibroids down the strength of statistical analysis, which reflect by borderline significance ($p=0.0547$). In addition, the study is conducting in single city, findings may be not broadly generalized. On other side cross-section design also gives only single time view of in 30-39 age group, restricted tracking of long term changes. At the end, result of USG may vary depend on operator, which may influence the findings.

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