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COMPARATIVE EVALUATION OF B MODE ULTRASOUND AND DOPPLER ULTRASOUND WITH HISTOPATHOLOGY IN THE DIAGNOSIS OF ADENOMYOMA AND LEIOMYOMA

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ABSTRACT **Background:** Accurate differentiation between Adenomyoma and Leiomyoma is critical for clinical management, particularly for fertility preservation. This study evaluates the diagnostic accuracy of B-Mode and Doppler Ultrasound compared to Histopathology.**Methods:** This prospective study was conducted on 207 women undergoing hysterectomy at SMS Medical College,Jaipur.Participants were randomized into two groups:Group1(B Mode Ultrasound,n=104) and group 2(Doppler Ultrasound,n=104).Ultrasound findings were correlated with Histopathological examination post hysterectomy. Sensitivity,specificity,positive predictive value(PPV) and negative predictive value(NPV) were calculated.**Results:** Leiomyoma was diagnosed in 62.02% of subjects and Adenomyoma in 33.17%.Histopathological correlation with B-mode ultrasound showed high sensitivity (90%) and PPV (95.2%) for Leiomyoma but lower specificity (42.5%) and NPV (56.4%) for Adenomyoma. Doppler Ultrasound demonstrated superior accuracy with sensitivity (92%), specificity (85%), PPV (88.3%), and NPV (89.2%) for Leiomyoma and sensitivity (85%), specificity (93.4%), PPV (89.2%), and NPV (88.2%) for Adenomyoma. Doppler vascular indices (VI, FI, VFI) were significantly higher in Leiomyoma ($p<0.05$). **Conclusion:** Doppler Ultrasound outperforms B-Mode Ultrasound in differentiating Adenomyoma and Leiomyoma,offering a reliable, non-invasive preoperative diagnostic tool critical for treatment planning, especially in fertility preservation.

KEYWORDS : Leiomyoma, Adenomyoma, B-Mode Ultrasound, Doppler Ultrasound.

INTRODUCTION:

Uterine Leiomyoma (Fibroid) and Adenomyoma are prevalent benign conditions, with Leiomyoma occurring in up to 70% of women and Adenomyoma estimated in 20–65% [1, 2]. Both conditions present overlapping symptoms, including abnormal uterine bleeding, pelvic pain, and infertility, complicating clinical differentiation [3]. Accurate diagnosis is essential, as leiomyomas are amenable to myomectomy, while Adenomyoma often require medical management or hysterectomy [4]. Ultrasound, particularly B-Mode and Doppler modalities, offers a cost-effective, non-invasive diagnostic approach. B-mode Ultrasound provides structural imaging, while Doppler Ultrasound assesses vascularity, potentially enhancing diagnostic precision [5]. This study aims to compare the diagnostic accuracy of B-mode and Doppler Ultrasound against Histopathological findings in distinguishing Adenomyoma from Leiomyoma, aiding in optimizing patient counselling and management.

Materials and Methods:

This prospective study enrolled 207 women scheduled for hysterectomy at SMS Medical College, Jaipur, between December 2022 and December 2023. Participants were randomized via coin-tossing method into two groups: Group 1 (B-mode ultrasound, n=104) and Group 2 (Doppler ultrasound, n=104). Inclusion criteria included women with suspected uterine pathology based on clinical symptoms. Exclusion criteria excluded morbidly obese women.Written informed consent was obtained .Ultrasound was performed using standard gynaecological ultrasound settings.B-Mode Ultrasound assessed margins, echogenicity, lacunae, and mass position. Doppler Ultrasound evaluated vascular location (peripheral vs. scattered) and 3D Power Doppler indices (Vascular Index [VI], Flow Index [FI], Vascular-Flow Index [VFI]). Uterine artery Doppler indices (Resistance Index [RI], Pulsatility Index [PI]) were also recorded.Post-hysterectomy specimen of uterus was fixed in 10% formalin and analyzed Histopathologically to confirm diagnoses of Leiomyoma or Adenomyoma.

Statistical Analysis: Data is analysed using SAS 9.3. Student's t-tests compared continuous variables, and Chi-square or Fisher's exact tests evaluated categorical variables. Sensitivity, specificity, PPV, and NPV were calculated with statistical significance set at p value <0.05.

Results: The mean age of cases was 52.05 ± 6.2 years, with 70.19% of subjects aged 40–59 years. Most (75.48%) were from lower socioeconomic background, 58.65% resided in rural area and 72.5% were multiparous. No significant demographic differences existed between groups ($p>0.05$). Heavy menstrual bleeding (64%) followed by dysmenorrhea (49.5%) were the most common symptoms.

Table 1: Comparison of B mode Ultrasound, Color Doppler Ultrasound and histopathogical diagnosis of Leiomyoma and Focal Adenomyosis

Findings	Focal Adenomyosis	Leiomyoma	P-value
B mode	29	75	<0.05
Histopathological report	39	65	
Color Doppler	38	66	>0.05
Histopathological report	35	69	

B-Mode Ultrasound identified Leiomyoma in 75 cases and Adenomyoma in 29, compared to Histopathological confirmation of 65 and 39 cases, respectively ($p<0.05$). Doppler Ultrasound diagnosed Leiomyoma in 66 cases and Adenomyoma in 38, aligning closely with Histopathology (69 and 35 cases, respectively; $p>0.05$).

Table 2: Comparison of Doppler vascular indices among Leiomyoma and Focal Adenomyosis

Vascular location			
	Leiomyoma (n=69)	Focal Adenomyosis (n=35)	P value
Peripheral (n, %)	53 (76.81)	6 (17.4)	.00
Scattered (n, %)	16 23.18)	29 (82.85)	
3 D power Doppler vascular indices	Mean± SD	Mean± SD	
VI	2.7 (1.8)	2.1 (1.5)	.01
FI	40.87 (6.1)	27.42 (6.4)	.00
VFI	1.34 (1.62)	0.95 (0.50)	.02
3 D power Doppler vascular indices	Mean± SD	Mean± SD	
RI (±SD)	0.85 (0.09)	0.87 (0.078)	.42
PI (±SD)	1.74 (0.72)	1.9 (0.6)	0.06
Myometrial mass volume (mm3) (mean ± SD)	10 (6.2)	8.1 (5.3)	0.7

As shown in table 2 Leiomyoma had a predominant peripheral vascular location (76.81%), while focal adenomyosis showed mostly scattered vascularity (82.85%, p=0.00). Doppler indices were higher in the Leiomyoma group: Vascular Index (VI) 2.7 ± 1.8 vs. 2.1 ± 1.5 (p=0.01), Flow Index (FI) 40.87 ± 6.1 vs. 27.42 ± 6.4 (p=0.00), and Vascular Flow Index (VFI) 1.34 ± 1.62 vs. 0.95 ± 0.50 (p=0.02). Uterine artery indices showed no significant differences (p>0.05).

Table 3: Comparison of B-Mode Ultrasound Parameters between Leiomyoma and Focal Adenomyosis

	Leiomyoma	Focal Adenomyosis	P-value
Margin			
Well circumscribed	60	6	<0.05
Indistinct	15	23	
Echogenicity			
Hyper	62	17	<0.05
Hypo	8	6	
Mixed	5	6	
Lacunae			
Present	6	14	<0.05
Absent	69	15	
Mass position			
Posterior	46	14	<0.05
Other	29	15	

As shown in table 2 Leiomyoma were more likely to have well-circumscribed margins (60 vs. 6 cases) and hyper-echoic echogenicity (62 vs. 17 cases), with both differences being statistically significant (p<0.05). Lacunae were present in 6 Leiomyoma and 14 Adenomyosis cases, and mass position was predominantly posterior in Leiomyoma (46 vs. 14), both showing significant differences (p<0.05). These findings highlight key sonographic distinctions between the two conditions.

Table 4: Table showing positive and negative predictive value, sensitivity and specificity of B Mode Ultrasound for initial diagnosis with histopathological correlation (n=104)

	Sensitivity%	Specificity%	PPV%	NPV%
Leiomyoma	90	82	95.2	82.7
Focal Adenomyosis	80.21	42.5	74.62	56.4

Table 5: Table showing positive and negative predictive value, sensitivity and specificity of Doppler Ultrasound for initial diagnosis with histopathological correlation (n=104)

	Sensitivity %	Specificity %	PPV %	NPV %
Leiomyoma	92	85	88.3	89.2
Focal Adenomyosis	85	93.4	89.2	88.2

B-mode ultrasound had a sensitivity of 90%, specificity of 82%, PPV of 95.2%, and NPV of 82.7% for Leiomyoma, but only 80.21% sensitivity, 42.5% specificity, 74.62% PPV, and 56.4% NPV for Adenomyosis. Doppler Ultrasound showed superior performance: 92% sensitivity, 85% specificity, 88.3% PPV, and 89.2% NPV for Leiomyoma; 85% sensitivity, 93.4% specificity, 89.2% PPV, and 88.2% NPV for Adenomyosis.

DISCUSSION:

This study confirms that Doppler Ultrasound outperforms B-mode Ultrasound in differentiating Adenomyoma from Leiomyoma, aligning with prior research Hanafi M. [6] Elkattan E, et al. [7]. The high sensitivity and PPV of B-Mode Ultrasound for Leiomyoma reflect its ability to detect well-defined masses, but its lower specificity and NPV for Adenomyoma indicate limitations in identifying infiltrative lesions [8]. Doppler Ultrasound's superior accuracy stems from its ability to assess vascular patterns—peripheral in Leiomyoma and scattered in Adenomyoma—corroborating findings by Chiang et al. [9] and Ya-Min et al. [10]. The significant differences in 3D power Doppler indices further enhance diagnostic precision, consistent with Minsart et al. [11].

These findings have clinical implications, particularly for fertility preservation, where distinguishing resectable Leiomyoma from Adenomyoma requiring medical management is critical [12]. Limitations include the study's modest sample size and lack of long-term follow-up, necessitating larger, longitudinal studies.

Conclusion: Doppler ultrasound, with its high diagnostic accuracy, is a superior non-invasive tool for preoperative differentiation of Adenomyoma and Leiomyoma compared to B-mode Ultrasound. Its integration into clinical practice can optimize treatment planning and patient outcomes, particularly in reproductive-age women desiring conception.

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