

**A PROSPECTIVE STUDY ON ROLE OF TRANSVAGINAL ULTRASOUND IN THE
EVALUATION OF ADENOMYOSIS WITH HISTOPATHOLOGICAL CORRELATION**Vivek Kumar Garg¹ and Manjula Sharma*²¹Department of Radiodiagnosis, NSCB Zonal Hospital Mandi, Himachal Pradesh, India.²Medical Officer, Civil Hospital, Sundernagar, Himachal Pradesh, India.***Corresponding Author: Manjula Sharma, MD**

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ABSTRACT

Objective: To evaluate the diagnostic accuracy of transvaginal ultrasound findings in adenomyosis by comparing them with histopathological findings of adenomyosis and to determine the most valuable sonographic findings in the diagnosis of adenomyosis. **Methods:** We conducted a prospective study in 90 females at the department of Radiodiagnosis, NSCB Zonal Hospital Mandi with a suspicion of adenomyosis on clinical basis. Patients underwent transvaginal ultrasound. If at least one of the following recognized features of adenomyosis was present, a diagnosis of adenomyosis was made heterogeneous myometrial echotexture, globular-appearing uterus, asymmetrical thickness of the anteroposterior wall of the myometrium, sub endometrial myometrial cysts, sub-endometrial echogenic linear striations or poor definition of the endometrial – myometrial junction. These sonographic findings were further correlated with histopathological findings. **Results:** The prevalence of adenomyosis in the patients was. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy of transvaginal ultrasound (TVS) for the diagnosis of adenomyosis 87.18%, 63.93%, 60.71%, 88.64% and 73.00% respectively. Most common feature on TVS was heterogeneous echotexture (87.18%), however it had poor specificity. The most specific sonographic feature was linear striations (96.72%). **Conclusion:** TVS is a very valuable technique for diagnosing adenomyosis with a good correlation with histopathological findings. The presence of sub endometrial echogenic linear striations, globular and bulky liver, variable myometrial thickness and myometrial cysts on TVS support the diagnosis of adenomyosis. Among the above mentioned TVS findings, echogenic sub endometrial linear striations have the highest diagnostic accuracy.

KEYWORDS: Adenomyosis, transvaginal ultrasound, histopathology.**INTRODUCTION**

Adenomyosis is a common uterine condition, characterized by migration of endometrial glands and stroma into the myometrium. These displaced glands incite spiral vessel angiogenesis and smooth muscle hyperplasia and hypertrophy, leading to thickening of the junctional zone, and cause diffuse uterine enlargement when severe. While some patients may be asymptomatic, most experience menorrhagia, chronic pelvic pain, and dysmenorrhea. The reported prevalence of adenomyosis varies widely from 5% to 70%, depending on the method used for diagnosis, with a mean prevalence of 20%–30%.^[1,2] A prospective study in 2015 found a 34% prevalence in nulliparous women, aged 18–30 years, who presented for counselling on contraception.^[3] While the exact cause of adenomyosis is unknown, the prevailing theory is that the endometrial glands directly invade the myometrium. Other theories include embryologically displaced pluripotent Mullerian remnants, invagination of the endometrium through the basalis along the intra-myometrial lymphatics, and displaced bone marrow stem

cells, disseminated through the vasculature.^[4] The most common opinion is that adenomyosis develops as a result of invagination of the basalis endometrium into the myometrium. Invagination may occur due to weakened myometrium from tissue trauma during previous pelvic surgery that enables the active endometrial tissue to grow into the injured lining. Invagination may also occur from an aberrant immune phenomenon in the affected tissue. Immunohistochemistry demonstrates increased numbers of macrophages that can activate T and B cells to produce antibodies and stimulate cytokines that may disrupt the endo-myometrial junction zone. The signs and symptoms of adenomyosis include pain, menorrhagia, metrorrhagia, dysmenorrhea, and dyspareunia. Menorrhagia is the most common symptom and is likely caused by the increased total volume of endometrial glands in the uterus and/or the increased myometrial vascularity from the ectopic glands.^[5] Dysmenorrhea is the second most common symptom and may result from either intra-myometrial bleeding of the displaced endometrial glands or increased levels of prostaglandin, as occurs with ectopic

endometrial tissue in endometriosis. At physical examination, patients often have pelvic tenderness with diffuse enlargement of the uterus. Adenomyosis is thought to play a role in infertility and should be considered in women undergoing fertility workup.^[6] Reports show an association between an increasingly thickened junctional zone and decreasing implantation rates during in vitro fertilization. Higher first-trimester miscarriage rates are reported in women with adenomyosis. Different sonographic features of adenomyosis have been reported, including uterine enlargement not explainable by the presence of myomas, asymmetrical thickening of the anterior or posterior wall, lack of contour abnormality or mass effect, anechoic lacunae or cysts of varying sizes, heterogeneous poorly circumscribed areas within the myometrium and increased echotexture of the myometrium.^[7,8,9] Many gray-scale US features have been described as characteristic of adenomyosis, including a globular uterus or asymmetric myometrial thickening; heterogeneous myometrium, with thin “venetian blind” shadows between areas of increased echogenicity; myometrial cysts; indistinctness of the margins of the endometrium and echogenic linear striations; and nodules extending from the endometrium into the myometrium. In an earlier study, Reinhold *et al*^[10] reported a sensitivity of 86%, specificity of 86%, positive predictive value of 71%, and negative predictive value of 94% for transvaginal US in the detection of adenomyosis, with heterogeneous and hypoechoic myometrium (with or without cysts) being the most common finding. Keeping this in mind, we conducted this study to compare various ultrasound features of adenomyosis with histopathology and to find most sensitive and most specific imaging features of adenomyosis.

MATERIALS AND METHODS

From March 2021 to September 2021, we studied 100 consecutive patients with clinical suspicion of adenomyosis, referred from the outdoor clinic of Department of Gynaecology to our department for transvaginal ultrasound. The patient ages ranged from 35 to 63 years. Out of 100 patients, 78(78%) patients were in perimenopausal age group, while remaining, 22(22%) were in postmenopausal age group. All the TVS scans were performed using Siemens Accuson unit. Ethical clearance was obtained from the institution. Whole procedure was explained to the patient prior to the beginning of ultrasound examination and consent was obtained from them. A female attendant was always present with patient during ultrasound examination. Transabdominal scan with full bladder was performed using 3-5 MHz convex probe and whenever needed transvaginal scan using 5-11 MHz probe frequency with empty bladder. Patient was asked to lie down comfortably in a supine position. Transabdominal probe was placed in the suprapubic area over the bladder and was caudally angled to obtain longitudinal section of uterus, cervix and vagina. Then the orientation was

changed to transverse section by angling the probe. While doing so, vaginal walls, cervix and body of uterus were studied. For transvaginal scan, the patient was placed in the lithotomy position after having emptied her bladder. Transvaginal probe was covered with sterile latex condom and secured by a rubber band in order to prevent cross-contamination. Before the condom was pulled over the shaft of the probe, a small amount of acoustic gel was inserted inside the tip of the condom. Further to facilitate the probe insertion, it was coated with the acoustic gel. The transducer was inserted into the vagina. Initially, a longitudinal scan was done followed by transverse scan. A standard format comprising uterus size, echotexture, endometrial thickness, contour, presence of associated abnormalities, right and left ovaries and presence or absence of fluid in pouch of Douglas was used with each patient. In accordance with multitude of previous studies and literature^[11,12,13], adenomyosis was diagnosed if one of the following imaging feature was present. Globular enlargement of uterus, asymmetrical thickness of anterior and posterior myometrium, poorly defined endometrial-myometrial interface, myometrial cyst, defined as around anechoic area with a diameter of 1 – 7 mm; sub-endometrial echogenic linear striations being hyperechoic and located near the endometrial – myometrial interface (fig. 1) and heterogenous myometrium; defined as the presence of indistinct area in myometrium with increased or decreased echogenicity.



Figure 1: TVS showing sub-endometrial echogenic linear striations located near the endometrial – myometrial interface (arrow).

All the histopathological examinations were done by pathologist at NSCB Zonal Hospital Mandi, who was blinded from the TVS findings. Uterine size, macroscopic appearance and associated pathological abnormalities were recorded. Sonographically adenomyosis was diagnosed if one of the below mentioned features were seen, sub-endometrial echogenic linear striations and/or nodules (specific sign), extending from endometrium and into inner

myometrium, hyperechoic islands, irregular endometrial–myometrial junction, tiny (1-5 mm) anechoic myometrial and sub-endometrial cysts (specific sign): reflecting glands filled with fluid, cystic striations, focal or diffuse myometrial bulkiness, which may be asymmetric, focal lesions have relatively indistinct borders, compared to leiomyomas, asymmetrical myometrial thickening. Histologically, presence of ectopic endometrial glands and/or stroma associated with surrounding smooth muscle hypertrophy and hyperplasia, located 2.5mm beyond the endometrial-myometrial interface is considered diagnostic of adenomyosis. Depending upon the depth of myometrial involvement, adenomyosis can be graded into, Grade 1,2 and 3.

STATISTICAL ANALYSIS

Statistical analysis was performed using IBM SPSS 20 for Windows. Sensitivity, specificity, NPV, PPV and accuracy were determined for individual findings and for the final diagnosis.

RESULTS

Histopathological findings: Histopathological examination, as mentioned above, showed features of adenomyosis was noted in 39/100 patients(39%).

TVS findings: Adenomyosis was detected in 56 patients on TVS. Out of 56 patients, 34(60.7%) had adenomyosis on histopathological evaluation. Out of 44 patients who had no sonographical features of adenomyosis, 5(11.36%) had histopathological features of adenomyosis. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were 87.18%,63.93%,60.71%,88.64% and 73.00% respectively.

TVS Adenomyosis	Histopathological Adenomyosis		
	YES	NO	TOTAL
YES	34	22	56
NO	5	39	44
TOTAL	39	61	100

Table 1: Comparison of adenomyosis patients diagnosed by transvaginal ultrasound (TVS) with histopathology results.

	Histopathological Adenomyosis	
	YES(39)	NO(61)
Globular Configuration	31	6
	8	55
Myometrial Antero-Posterior Asymmetry	29	16
	10	45
Subendometrial Echogenic striations	21	2
	18	59
Myometrial cysts	29	25
	10	36
Heterogenous myometrium	34	34
	5	27

Table 3: Sensitivity, specificity, PPV and NPV of transvaginal ultrasound findings for the diagnosis of adenomyosis.

TVS FINDINGS	Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
Globular configuration	79.49%	90.16%	83.78%	87.30%	86.00%
Myometrial anteroposterior asymmetry	74.36%	73.77%	64.44%	81.82%	74.00%
Identification of endometrial myometrial junction	46.2%	81.8%	60.00%	72.0%	68.6%
Subendo-myometrial metrial echogenic linear striations	53.85%	96.72%	91.30%	76.62%	80.00%
Myometrial cysts	74.36%	59.02%	53.70%	78.26%	65.00%
Heterogeneous myometrium	87.18%	44.26%	50.00%	84.38%	61.00%

Table 2 outlines comparison of ultrasound features of adenomyosis with histopathological correlation. Similarly table 3 outlines Sensitivity, specificity, PPV and NPV of transvaginal ultrasound findings for the diagnosis of adenomyosis. For globular configuration, myometrial antero-posterior asymmetry, identification of endometrial myometrial junction,

Subendo-myometrial metrial echogenic linear striations, Myometrial cysts and Heterogeneous myometrium, sensitivity, specificity, PPV and NPV were (79.49%,64.44,81.82% and74.36%),(73.77,64.44% and 81.82%), (46.2%,81.8%,60.00% and 72.0%), (53.85%, 96.72%, 91.30% and 76.62%), (74.36%, 59.02%,53.70% and 78.26%), (87.18%, 44.26%, 50.00% and 84.38%) respectively.

DISCUSSION

Adenomyosis is one of the most common uterine diseases seen in peri and post-menopausal females. The reported prevalence of adenomyosis varies widely from 5% to 70%, depending on the method used for diagnosis, with a mean prevalence of 20%–30%. Adenomyosis is rarely isolated. It is generally associated with other uterine pathology, such as leiomyoma, endometrial hyperplasia or adenocarcinoma. The data support the concept that adenomyosis is a hormone-dependent disorder, as it is associated with persistently elevated estrogen levels. Transvaginal ultrasound examination has been recommended for the diagnosis of adenomyosis. Transvaginal US is now the primary imaging modality for the diagnosis of adenomyosis, and its widespread use has allowed for a better understanding of the scope of adenomyosis in premenopausal women of all ages. Transvaginal US can be used to confidently diagnose adenomyosis in a majority of cases, particularly if multiple US findings manifest. Specific histologic-based criteria aid in the US interpretation and include findings related to the ectopic endometrial glands and stroma, myometrial hyperplasia/hypertrophy, and increased vascularity. Advanced US techniques, including obtaining 2D and 3D coronal reformatted images and cine clips and performing SIS, can be used to corroborate standard US findings, especially when coexisting leiomyomas or endometriosis manifest. It must be noted that histopathological correlation however remains the gold standard for the diagnosis of adenomyosis.

CONCLUSION

Our study suggest that sub-endometrial linear striations, a regularly enlarged uterus with a globular appearance and myometrial cysts have the highest specificity and PPV, but have lower sensitivity compared with heterogeneous myometrium, for the diagnosis of adenomyosis.

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