Original Research Article

MR evaluation of uterine mass lesions in correlation with transabdominal, transvaginal ultrasound using HPE as a gold standard

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Abstract

Background: The incidence of mass lesions in the uterus is common all over the globe. Uterine mass lesions affect 15 to 20% of women in their reproductive years. **Aim:** To assess the MRI characteristics of uterine mass lesions and evaluate the sensitivity of MRI, transabdominal ultrasonography, and transvaginal ultrasound in defining uterine mass lesions. **Materials and Methods:** A prospective research was undertaken on 52 women who had uterine masses. Transabdominal ultrasound, transvaginal ultrasound, and MRI were performed on all patients. **Results:** There were 32 patients in their 30s to 40s, 8 in their 40s to 50s, 8 in their 50s to 60s, and 4 in their 60s, with an average age of 42.5 years. Patients were premenopausal to postmenopausal, with 68 percent premenopausal and 33 percent postmenopausal. The patients range in age from 30 to 65 years old. Premenopausal women accounted for 68 percent of the participants. The most prevalent presenting symptom was pain (69 percent), followed by bleeding PV (37 percent), and discharge PV (3 percent) (32 percent). 9.6% of couples struggle with infertility. Dymenorrhea was experienced by 46% of the women. According to their histological diagnostic, patients were separated into five groups. Adenomyosis affected 12 individuals, fibroids affected 24 patients, endometrial cancer affected three patients, cervical cancer affected ten patients, and cervical polyps affected two patients. In 17 of the people, there was adnexal pathology. **Conclusion:** Outstanding spatial resolution MR imaging with the CP spine Array coil is accurate for characterising, localising, and evaluating the number of lesions in benign uterine mass lesions, as well as for staging malignant mass lesions. A pelvic MRI is the best way to identify adenomyosis. Myometrial masses, such as fibroid, may be detected via transabdominal ultrasonography.
Keywords: Hysterosonosalphingography, Computerized Tomography, Magnetic Resonance Imaging.

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INTRODUCTION

The incidence of mass lesions in the uterus is common all over the globe. In the reproductive age range, 15 to 20% of women will have uterine mass lesions. Adenomyosis was found in 25% of them, while fibroid uterus was found in 45 percent of them. However, previous to surgery, transabdominal ultrasonography was only utilised to identify less than 5% of all adenomyosis patients. Prior to surgery, a definite diagnosis of adenomyosis is required. Transabdominal ultrasonography, transvaginal ultrasound, Color Doppler, Hysterosonosalphingography, Computerized Tomography, and Magnetic Resonance Imaging are just a few of the imaging modalities that have been used to characterise mass lesions throughout the years. Transabdominal ultrasonography is still the preferred screening imaging modality. Before deciding on a treatment method, it's critical to acquire a good image of the lesion. A myoma may be treated by a myomectomy or hysterectomy, for example. However, in the case of Adenomyosis, hysterectomy is the best treatment choice for a lasting cure. This highlights the need of a correct

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preoperative diagnosis.[1,2] In situations of submucosal fibroid, hysteroscopic removal is possible if the endometrial surface circumference is larger than 50%. A laparoscopic resection is advised if everything else fails. Similarly, laparoscopic resection or hysterectomy may be considered based on the size and location of intramural fibroids. It emphasises the need of employing several metrics such as size and circumference to determine the precise location and extent of the lesion. Some of the issues were answered by transvaginal ultrasound, but it is dependent on the operator, and large lesions cannot be brought within the area of transvaginal ultrasound. Hysterosonosalphingography is only useful for endometrial lesions. CT scans are used to evaluate uterine lesions, particularly for carcinoma staging. MRI has become a diagnostic tool in preoperative exams due to the continued demand for a better imaging modality for conclusive characterization of uterine mass lesions. A body surface coil is used in T1, T2 weighted sequences in the sagittal, axial, and coronal planes in MRI, which is a relatively recent imaging method. The number, position, size, and other parameters of uterine mass lesions, as well as degenerative changes within the lesions and the extent of the lesion, are assessed using transabdominal ultrasound, transvaginal ultrasound, and MRI in this study. The final imaging diagnosis was matched to the histopathological findings. The sensitivity of each parameter in detecting lesions, the definition and differentiation of lesions, and the sensitivity and specificity of each modality in making final diagnoses against HPE reports were all compared amongst the three modalities.

MATERIALS AND METHODS

A prospective study of 52 individuals with suspected uterine tumours that were referred from OP. All of the patients had a transabdominal ultrasound, a transvaginal ultrasound, and an MRI. Depending on the final diagnosis, they received endometrial curettage, cervical biopsy, myomectomy, or hysterectomy. The final histopathology report was utilised as the gold standard for comparing the findings and final diagnosis of each imaging modality. Grey-scale diagram Transabdominal and transvaginal ultrasonography were performed using an Aloka 3500 series equipment with a 3.5-megahertz convex probe and a 5.0-megahertz transvaginal probe. The MRI was performed using a Siemens 1.5 tesla superconducting magnetome with a CP spine array coil. A preliminary abdominal examination, as well as a speculum and vaginal examination, were done. The bladder was full and optimal conditions when the Transabdominal Ultrasound was conducted, then the bladder was emptied and the Transvaginal Ultrasound was performed. During both Ultrasound tests, the following uterine parameters were noted: Endometrium – homogenous / in homogeneous, echogenic / hypoechoic in contrast to the myometrium, endometrial thickness – measured from the myometrial – endometrial junction (outer echogenic layer) to the opposite myoendometrial junction The presence or absence of endometrial cavity fluid, any mass lesion inside the endometrium, and the characteristics of any mass present are all factors to consider (single or numerous). The myometrium was examined for the presence of any myoma, its location (submucous, intramural, and subserosal), the number of lesions, their echogenicity, calcification, cystic change within the lesion, and shadowing. Any cysts in the myometrium, whether single or many, were noted, as well as their location, such as anterior or posterior myometrium. Is there an indentation on the bladder wall as a result of the lesion? Is the cervix healthy or unhealthy? Is a nabothian cyst, polyps, or tumour present? Is there a depression on the bladder wall as a result of the mass? Is there a depression on the bladder wall as a result of the mass? Bilateral adnexa was performed to determine if the ovary was normal or abnormal, and if so, whether there were any masses or cystic abnormalities. Other conventional abdominal organ examinations were carried out, with any positive findings for hydronephrosis, ascites, or lymphadenopathy being recorded.

The maximum junctional zone thickness was measured and the junctional zone to myometrial thickness ratio was assessed using MRI in addition to the Ultrasonogram data. The thickness of a single junctional zone layer is measured at its thickest point, and the thickness of the myometrium is measured at the same level. Both T1 and T2 weighted images revealed the severity of the lesions. The number and location of lesions were also noted. In instances of endometrial lesions, the quantity of myometrial invasion was quantified, while in cases of Carcinoma Cervix, the size of the lesions was measured.

Inclusion Criteria: Patients who are willing to endure all three tests as well as surgery for uterine mass lesions.

Exclusion Criteria: The histopathology report was either not completed or was not accessible. Patients with MR-incompatible equipment or implants, as well as Claustrophobia patients.

This research was conducted in accordance with all ethical requirements and with the patient's consent and full participation. The ability of MRI, transabdominal ultrasound, and transvaginal ultrasound to characterise and diagnose uterine mass lesions was compared to histological findings, and the data were examined using several statistical tests. The MR characteristics of each lesion were also evaluated. The transabdominal ultrasound, transvaginal ultrasound, and MRI imaging findings were compared to the final histological results

after hysterectomy, myomectomy, fractional curettage, and cervical biopsy. Diagonal agreement, Cohen's Kappa, and Z value are determined when comparing two modalities in diagnosing mass lesions in the uterus, such as Transabdominal USG – MRI, Transvaginal USG – MRI, and Transabdominal USG – Transvaginal USG. In all modalities, the number of examples with the same end result for the presence of mass is reported as a percentage of diagonal agreement. For all patients falling under each final diagnosis, sensitivity, specificity, appropriate classification, misclassification, and Kappa values for each modality were calculated and compared. For accurate classification, there must be agreement between the diagnostic of that modality and HPE. When the diagnosis and HPE of a modality contradict, misclassification occurs. Cohen's Kappa is used to compare the modalities' correlation. The Kappa values were 0.0-0.2 (no correlation), 0.2-0.4 (acceptable correlation), 0.4-0.6 (moderate correlation), 0.6-0.8 (excellent correlation), and 0.8-1.0 (very strong correlation).

RESULTS

Table 1: Demographic details in study population

Age of patients	No of patients	Percentages
<40	32	61.5
41-50	8	15.4
51-60	8	15.4
>60	4	7.7
Total	52	100
Presenting complaints		
Pain	36	69.2
Bleeding PV	19	36.5
Discharge PV	16	30.78
Mass Abdomen	3	5.7
Loss Of Weight and Appetite	3	5.7
Dysmenorrhea	3	5.7
Menopausal Status		
Premenopausal	35	67%
Post Menopause	17	33%

Table 2: Comparison of modalities in myometrial mass detection myometrial mass transabdominal, TV, USG

		mass absent	ill defined	present	Total
Myometrial mass transabdominal, TV USG					
USG MASS	mass absent	18	2	1	21
	ill defined	1	2	9	12
	present	0	0	19	19
Total		19	4	29	52
Myometrial mass transabdominal USG, MRI					
USG MASS	mass absent	17	3	1	21
	ill defined	1	1	10	12
	Present	0	0	19	19
Total	18	4	30	52	
Myometrial mass transvaginal USG, MRI					
Trans Vaginal USG MASS	mass absent	18	1	0	19
	ill defined	0	3	1	4
	present	0	0	29	29
Total		**18**	**4**	**30**	**52**

Table 3: Categorizing myometrial mass transabdominal and transvaginal in USG, MRI

		MRI					Total
		submucosal	intramural	subsero	subsero+ intramural	submuco+intramur+subsero	
Categorizing myometrial mass transabdominal USG, MRI							
USG	submuco	0	0	0	0	0	0
	intramural	5	6	0	0	0	11
	subsero	0	1	1	0	0	2

	subsero+ intramur	0	0	0	6	5	11
	Total	5	7	1	6	5	24
		categorizing myometrial mass transvaginal USG, MRI					
TV USG	submuco	2	0	0	0	0	2
	intramu	3	7	0	0	0	10
	subsero	0	0	1	0	0	1
	subsero+ intramur	0	0	0	6	5	11
	Total	**5**	**7**	**1**	**6**	**5**	**24**

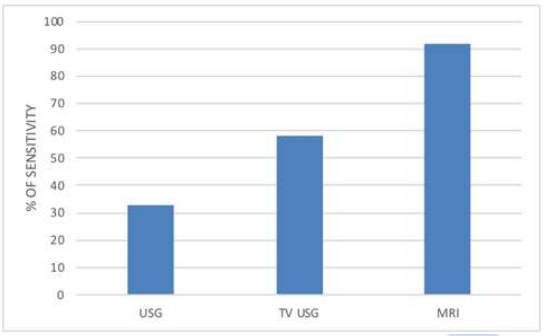

Figure 1: Comparison of Sensitivity of adenomyosis detection

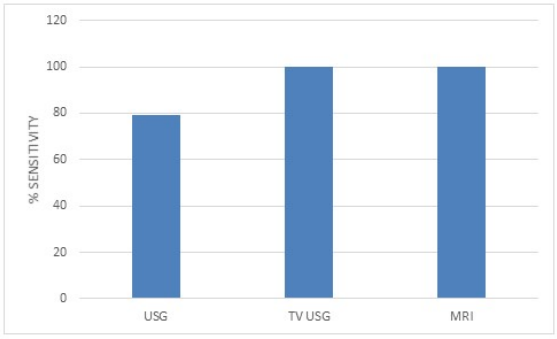

Figure 2: Comparison of Sensitivity of fibroid detection

DISCUSSION

Transabdominal USG, transvaginal USG, and MRI were performed on 52 patients referred from the Institute of Obstetrics and Gynecology for investigation of uterine mass lesions. Depending on the final diagnosis, they underwent a myomectomy, hysterectomy, endometrial curettage, or cervical biopsy. The patients ranged in age from 30 to 65 years old. There were 32 patients in their 30s to 40s, 8 in their 40s to 50s, 8 in their 50s to 60s, and 4 in their 60s, with an average age of 42.5 years. Patients were premenopausal to postmenopausal, with 68 percent premenopausal and 33 percent postmenopausal. The bulk of the patients in our study were women of childbearing age. Because benign mass lesions are more common in this age group, this is the case. This has been emphasised by VG Padubidri, Shirish N Daftary, and others.

In our research, 36 patients (69.2%) reported pain, 19 patients (37%) reported bleeding, 3 patients (6%), felt a mass on their own, 16 patients (31%) reported discharge PV, 1 patient (1.9%) reported weight loss, and 3 patients (5.8%) reported a lack of appetite. Only a few folks had more than one complaint. However, the most common symptoms were abdominal pain, bleeding PV, and discharge PV. The 52 patients, with the exception of two, were all married (3.8 percent). With the exception of 5 (9.6%) infertile patients, all of the married patients had more than one child. In 29 percent of the 52 individuals, permanent sterilisation was discovered. In the remaining 71 percent of patients, 20% were taking temporary contraception. The proliferative phase was seen in 33% of premenopausal women, whereas the secretory phase was observed in 33%. In all, 21% of the patients had abnormally high flow, 7% had abnormally high flow with clots during menstruation, and 46% had dysmenorrhea. When identifying myometrial mass lesions, three sets of data are acquired by comparing two modalities in each event. In diagnosing myometrial mass lesions, the diagonal agreement between transabdominal USG and MRI was 71%. Only 71 percent of the mass lesions found on MRI are also shown on USG, according to the study. The diagonal agreement between the transvaginal USG and MRI was 96 percent. The diagonal agreement between the transabdominal USG and the transvaginal USG is 75%. In identifying myometrial mass lesions, there is a 54 percent diagonal agreement between USG and MRI, and a 67 percent agreement between transvaginal USG and MRI. This is due to the fact that transabdominal USG identifies no submucosal lesions, but transvaginal USG detects just two out of six submucosal lesions. All of them, however, may be seen on an MRI. The easiest technique to figure out where a lesion is and how many there are is to utilise MRI. It offers a visual picture to the surgeon. All infertile women should have a magnetic resonance imaging (MRI) scan before having uterine preservation surgery. Two, four, and five people with fibroids had cystic degeneration shown by transabdominal ultrasonography, transvaginal ultrasound, and MRI, respectively. In patients, transabdominal ultrasonography, transvaginal ultrasound, and MRI all show calcification. In a total of 52 cases, USG had a sensitivity of 79 percent, specificity of 86 percent, and kappa of 0.65 (sufficient), with P 0.01 suggesting statistical significance. Transvaginal ultrasonography has 100% sensitivity in detecting fibroid, an 89 percent specificity,

and a kappa of 0.89, P0.01. MRI has a sensitivity of 100 percent and a specificity of 96 percent. This is because an MRI scan in one patient previously diagnosed with both adenomyosis and fibroid showed a localised adenomyoma with diffuse adenomyosis. There was no fibroid to be found. On USG, many intramural adenomyosis lesions are classified as fibroid, which reduces the specificity.

Duiak CM, Turner DA, Patel SK, Archie JT, Silver B, Norusis M etal[3] on their study MRI sensitivity and accuracy on uterine leiomyomas in infertile women were 85 percent and 94 percent, respectively, which was better than USG (Transabdominal) sensitivity of 69 percent and accuracy of 87 percent. Because the modalities' specificity did not vary much, the researchers concluded that MR imaging is better to USG or HSG for detecting leiomyomas prior to surgery. With a USG sensitivity of 79 percent and an MR sensitivity of 100 percent, this study backs up our results.

Zawin M, Mc carthy S, Scout LM, Comite F *et al.*[4] studied High-field MRI and USG were used to assess the pelvic health of 23 women with leiomyomas. They observed that in all cases, MRI allowed for exact uterine volume determination, however that USG was limited in uteruses larger than 140 cc. Significant expansion in USG obscured the clarity of contour imperfections. The endometrial stripe and junctional zone were not seen in 21 of 23 ultrasound tests. In the pelvic examination of women with leiomyoma, the researchers discovered that MRI is superior than ultrasound because it detects more submucosal (14) lesions. This is in line with our results, which showed that transabdominal ultrasonography revealed no submucosal abnormalities. Two of the six anomalies were discovered using transvaginal ultrasound, whereas all six were discovered using MRI. Pain was reported by ten of the 12 patients with histopathologically confirmed adenomyosis, five of whom had bleeding PV, five of whom had both, and four of whom had discharge PV. Dymenorrhea was found in 10 of them. One of the patients struggled with infertility. The patients were all between the ages of 31 and 39 years old. This is in line with the results of VG Padubidri, Shirish N Daftary, and colleagues2, who discovered that adenomyosis is more typically detected in parous women over the age of 40 who have menorrhagia and dysmenorrhea that is steadily deteriorating. Pelvic discomfort and dyspareunia are two further adenomyosis symptoms. On transabdominal ultrasonography, eight of them had inhomogenous myometrial echo. A transvaginal scan revealed that 11 of them had myometrial inhomogeneity. Seven people had anterior and posterior wall myometrial asymmetry on transabdominal and transvaginal ultrasonography. The abdominal scan indicated a concerning intramural hypoechoic lesion in four people. They had adenomyosis, according to a transabdominal ultrasonography. Transabdominal ultrasonography, transvaginal ultrasound, and MRI had a specificity of 46 percent, 92%, and 100%, respectively, in differentiating between adenomyosis and fibroid in our study. The positive predictive value is 24%, 78%, and 100%, respectively. The false positive rate is 58%, 8%, and 0%, respectively, whereas the negative predictive value is 58%, 82%, and 96 %.

Kang S, Turner DA *et al.*[5] study on Adenomyosis: specificity of 5mm as the maximum normal uterine JZ thickness in MR images discovered that if adenomyosis is diagnosed only on the basis of junctional zone thickness in MR images, 5mm should not be regarded as the upper limit of normal. Because this assumption might result in a large number of false positives. The minimal JZ thickness, according to the previous study's requirements, is 10 mm.

Phillips *et al.*[6] study on Transabdominal uterine biopsy or resectoscopic endometrial biopsy confirmed the MRI diagnosis of adenomyomatosis in all 20 instances. In a similar vein, MRI was utilised to diagnose all 12 positive cases in our research.

Ascher SM *et al.*[7] study on 20 women, transvaginal ultrasonography and MRI were conducted. There was pathological evidence in every instance. 17 persons were diagnosed with adenomyosis. In MR, 15 of the 17 cases were correctly recognised. One erroneous positive diagnosis and two false negative diagnoses were made using magnetic resonance imaging. Transvaginal ultrasonography was used to successfully diagnose 9 of the 17 cases. There were one false positive and eight false negatives, with the most prevalent reason of erroneous negative diagnosis by transvaginal ultrasonography being a misdiagnosis of adenomyosis as a leiomyoma. In our investigation, one case classified as fibroid by MRI turned out to be localised adenomyoma, similar to the preceding one. Due to adenomyosis being misconstrued as leiomyoma, only 7 of the 12 patients were correctly recognised as adenomyosis in TV USG.

Tamai K, Togashi K etal[8] study on Imaging features and histopathologic aspects of MR Adenomyosis, as well as diagnostic pitfalls Endometrial stromal sarcoma, myometrial contractions, leiomyoma, adenomatoid tumour, metastasis, endometrial cancer, and endometrial cancer have all been linked to adenomyosis diagnosis. Conclusion: Knowing the various adenomyosis presentations, as well as the possible challenges in differential diagnosis, assists in the selection of appropriate treatment options.

Mark AS *et al.*[9] studied There were 21 premenopausal women in all, eight with adenomyosis, twelve with fibroids, and one who was normal. All eight adenomyosis were found on MRI. Fibroids were effectively diagnosed

in 10/12 cases using MRI. In two instances, distinguishing between adenomyosis and fibroid proved challenging.

Reinhold C *et al.*,[10] in their study discovered that adenomyosis in transvaginal ultrasonography had a sensitivity of 86%, specificity of 86%, positive predictive value of 71%, and negative predictive value of 94 percent in 25/29 cases. Transabdominal ultrasonography indicated heterogeneous echotexture in 21/25 (84%) cases, hypoechoic regions with cysts in 3 (12%) cases, and heterogeneous myometrium in 1 case (4%).

Togashi K, Ozaga H *et al.*[11] study, there were 71 individuals with fibroid, 16 with adenomyosis, and six with both. In our research, there were 52 patients: 24 with fibroid, 12 with adenomyosis, and one with both fibroid and adenomyosis.

Byun JY *et al.*[12] study, 66.7 percent (30 cases) of the patients had diffuse adenomyosis, whereas 33.3 percent had localised adenomyoma (15 cases). In extensive adenomyosis, JZ measures 7-37mm. High signal intensity foci were only visible in T2 weighted images in four instances with focal adenomyoma, whereas high signal intensity foci were found in both T1 and T2 weighted pictures in 11 cases. Ten of the subjects in our research had extensive adenomyosis, whereas two had localised adenomyosis. JZ is available in a variety of thicknesses ranging from 10 to 22 mm. In the course of our examination, one patient acquired a chocolate cyst (endometriosis).

Sugimura K, Okizuka H, Imaoka J, Kaji Y, Takahashi K, Kitao M, Ishida T. *et al.*[13] in their study on 35 patients, adding fat saturated photographs to endometriosis photos improved diagnostic accuracy. As a consequence, using them in combination with standard imaging in the diagnosis of endometriosis is recommended.

CONCLUSION

High spatial resolution MR imaging with the CP spine Array coil is accurate for characterising, localising, and evaluating the number of lesions in benign uterine mass lesions, as well as for staging malignant mass lesions. A pelvic MRI is the best way to identify adenomyosis. Myometrial masses, such as fibroid, may be detected via transabdominal ultrasonography. The transabdominal and transvaginal USGs are more effective in detecting calcific degeneration. Cystic degeneration may be detected more effectively using transvaginal USG and MRI. Transvaginal USG is less effective than MRI in detecting submucosal lesions. Transvaginal USG may be used to identify endometrial lesions as a screening tool. The transabdominal USG does not work. T2 weighted and contrast enhanced T1 weighted MRI sequences are useful in lesion characterization. An MRI diagnosis will not be adequate to eliminate the need for an endometrial biopsy in cases of endometrial cancer. MRI may help detect myometrial invasion and lesion extension in endometrial cancer patients. In cervical lesions, MRI detects even smaller nabothian cysts than Transvaginal USG and Transabdominal USG. Cervical polyps are recognised accurately. Transvaginal and transabdominal USG identify the extent of the posterior cervix, parametrial invasion, body or vaginal extension, haematometrocolpos, and haematosalphinx better than MRI, allowing for more exact staging. Because surgical techniques for fibroid and adenomyosis vary significantly, MRI should be used in the preoperative assessment of all suspected cases of adenomyosis and infertility. Finally, we conclude that, in comparison to transabdominal and transvaginal USG, pelvic MR Imaging is a well-tolerated, noninvasive, and accurate approach for detecting uterine mass lesions with excellent histological correlation. As a consequence, it's a good preoperative imaging tool for assessing the number and size of uterine mass lesions.

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