MRI EVALUATION OF UTERINE MASS LESIONS IN CORRELATION WITH TRANSABDOMINAL AND TRANSVAGINAL ULTRASOUND

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ABSTRACT

Background: *The uterine pathologies constitute one of the most common problems among women. The most common of them are adenomyosis, uterine leiomyoma, carcinoma of uterus and cervix and endometrial pathologies including polyp and hyperplasia.*

Aim of the work: *to compare the role of (MRI) and (trans abdominal & trans vaginal) in assessment of uterine masses.*

Patients and Methods: *This prospective study was performed on 25 female patients with suspected uterine lesions. They were referred from the Gynecology Department to the Radiology Department of Ain Shams University Hospital to perform pelvic MRI study in period between from June 2019 till April 2021.*

Results: *Ultrasonography among the studied cases detected that Endometrial hyperplasia was the most frequent finding (32.0%), followed by myoma (28.0%), adenomyosis (16.0%), polyp (12.0%), carcinoma (8.0%) and (4.0%) without detected abnormality. However, MR evaluation among the studied cases detected that myoma was the most frequent finding (28.0%), followed, adenomyosis (24.0%), polyp (5.0%), endometrial hyperplasia (16.0%) and carcinoma (12.0%). Hence, our results revealed that there was statistically significant perfect agreement between MRI evaluation and final diagnosis by hysteroscopy and histopathology regarding overall diagnosis of uterine lesions (p value<0.001). Consequently, our study revealed that MR had sensitivity and specificity of 100% for diagnosis of all uterine lesions (uterine myomas, adenomyosis, polyp, hyperplasia and carcinoma).*

Conclusion: *MRI has a sensitivity of 100% with a superior modality.*

Keywords: *Uterine lesions, MRI in Uterine Mass.*

INTRODUCTION:

Uterine growths are tissue enlargements of the female uterus. Uterine growths can be caused by either harmless or dangerous conditions. Growths are sometimes referred to medically as masses or tumors. An example of a harmless (benign or non-cancerous) growth, which does not pose a threat, is a polyp of the cervix. Some growths, such as uterine fibroids, are benign, but they can still cause some annoying problems, such as bleeding. Dangerous growths of the uterus include cancerous (malignant) tumors **(1)**.

Endometrial carcinoma is the most common gynecologic malignancy, and cervical carcinoma is the third most common. Uterine leiomyoma is by far the most common benign tumor of the female pelvis **(2)**.

Imaging plays a crucial role in the diagnosis and management of gynecological

diseases. Modalities that are primarily used in the assessment of female pelvis include Ultrasonography (USG), Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) **(3).**

Ultrasound is traditionally used as first line investigation in evaluating abdomen and pelvic pathologies for its wide availability, broad acceptance, lack of radiation exposure, cost affordability, reproducibility, real-time assessment, vascular evaluation and its role in guiding procedures. The short comings being operator and skill dependency, limited field of view, patient size limitations, bowel gas, less sensitive in parametrial lesion evaluation **(4).**

Even though it is used as first line investigation in evaluating abdominal and pelvic pathologies, it has got its limitations in proper characterization, finding organ of origin for large lesions, parametrial invasion and staging of malignancy and so on. Thus, to overcome these limitations and to assess the indeterminate and miscellaneous lesions the optimal imaging modality used in MRI pelvis**(5)**.

MRI is increasingly used in assessing female pelvic pathologies as it is free of radiation exposure & iodinated contrast usage, has got greater field of view, contrast resolution, multiplanar imaging capabilities, good tissue characterization and ability to differentiate recurrence and residual from post-operative scarring. Thus, its role is well established in diagnostication, prognostication, planning management and follow up imaging of different pelvic pathologies **(5).**

The cytological and particular histopathological evaluation would help in coming to a definite diagnosis and thus in the present study the radiological findings from ultrasonography and MRI imaging are correlated with the pathological findings and the post-test variabilities are assessed used a standard SSPS statistical software **(6).**

PATIENTS AND METHODS:

After ethical committee approval and written consents from the patients, this prospective study was performed on total 25 female patients in the reproductive age with suspected uterine lesions. They were referred from the Gynecology Department to the Radiology Department of Ain Shams University Hospital to perform pelvic MRI study in period between from June 2019 till April 2021. Patients were evaluated for uterine lesions in which USG and MRI was done and correlated.

Study population: Women with uterine mass lesions evaluated for uterine lesions in which USG and MRI was done and correlated at Ain Shams university hospital with the following inclusion criteria:

Inclusion criteria: All females with suspected uterine related gynecological problems, who underwent pelvic US and showed a uterine mass.

Exclusion criteria: 1st trimester pregnancy as MRI is still controversial in this particular group, Patients with renal insufficiency, Patients with implantable devices (intracranial aneurysm clips or cardiac pacemaker), Patients who have a metallic foreign body (metal sliver) in their eye.

Study Procedures: All participants were submitted to the following:

- Patient consent.
- Proper history taking and clinical examination.
- Laboratory tests including kidney function tests.
- Imaging procedures:
  - -Trans abdominal ultrasound.
  - -Trans vaginal ultrasound.

- -Magnetic resonance imaging**.**

For ultrasound:

The patient position lying face-up on an examination table

- Apply a warm water-based gel to the area of the body being studied.
- The transducer is placed on the body and moved back and forth over the area of interest until the desired images are captured.
- Trans abdominal ultrasound requires full bladder.
- Trans vaginal ultrasound requires empty bladder.
- Using 5 to 10 MHz transducers.

For MRI;

- MR imaging will be performed with high field strength 1.5 tesla on Philips Achieva XR, with the patient in supine position.
- Total study time ranges from 20 to 30 minutes.
- Lesions detection and characterization will be assessed separately for each sequence (unenhanced T1 weighted, proton density weighted and contrast enhanced T1 weighted images) and for combinations of sequences (unenhanced T1 and T2 weighted images, and unenhanced and contrast enhanced T1 weighted images) DWI and ADC.
- Intravenous injection of contrast agent (Gadolinium dimeglumine) (Gd-DTPA) (Magnavist, Schering AG Berlin, Germany) using a power injector at a dose of (0.1 mmol /kg).

Results interpretation and data recording:

- The MRI results will be compared with the results of Ultrasonography in assessment of uterine mass lesions.
- Statistical analysis of the results will be done.

Ethical Considerations: The patient data were anonymous. Data presentation were not be by the patient's name but by diagnosis and patient confidentiality was protected. An informed consent was taken from all participants, it was in Arabic language and confirmed by date and time. confidentiality was preserved by assigning a number to patients initials and only the investigator knew it

Conflict of interest: the candidate declared that there is no conflict of interest and the cost of the study was paid by the candidate.

Statistical analysis: Analysis is to be performed using SPSS for windows v20.0, Data to be presented in terms of range, mean and standard deviation (for numeric parametric variables); range, median and inter-quartile range (for numeric non-parametric variables); or number and percentage (for categorical variables). Difference between two independent groups is to be analyzed using independent student's t-test as well as the mean difference and its 95% CI (for numeric parametric variables); or chi-squared test as well as the risk ratio and its 95% CI (for categorical variables). Binary logistic regression analysis is to be performed for estimating the association between good/poor response and the measured variables ROC curves are to be constructed for estimating the validity of measured variables as predictors of good or poor response validity is to be presented in terms of sensitivity, specificity, positive and negative predictive values and their corresponding 95% Cis significance level is set at 0.05.

RESULTS

During this study, 35 patients were assessed for eligibility and 25 patients were included in the study. Of all eligible patients, 8 patients were excluded from the study based on the inclusion criteria and 2 patients refused to participate in of the study.

Ultimately, the analysis was based on the data of 25 female patients with uterine mass lesions.

Table (1): Demographic characteristics of the studied cases.

Characteristics		Mean±SD	Range
Age (years)		44.1±7.0	35.0–64.0
Duration of complain (months)		5.0±3.5	1.0–14.0
		Median (1st−3rd IQ)	Range
Parity		3.0 (2.0–3.5)	0.0–5.0
		N	%
Main presenting complaint	Bleeding	17	68.0
	Pelviabdominal pain	6	24.0
	Pelviabdominal mass	2	8.0

Total=25. IQ: Interquartile

Table (1) shows that Demographic characteristics among the studied cases. Mean±SD and Range of age were 44.1±7.0, 35.0–64.0 year, complain duration were 5.0±3.5, 1.0–14.0. While Median (1st−3rd IQ) and Range of parity were 3.0 (2.0–3.5), 0.0–5.0. Main presenting complain were Bleeding (68.0%), Pelvi-abdominal pain (24.0%) and Infertility (8.0%).

Table (2): Ultrasonography diagnosis among the studied cases.

Findings	N	%
Hypeplasia	8	32.0
Myoma	7	28.0
Adenomyosis	4	16.0
Polyp	3	12.0
Carcinoma	2	8.0
NAD	1	4.0

Table (2) shows that that Ultrasonography diagnosis among the studied cases. Endometrial hyperplasia was the most frequent finding (32.0%), followed by myoma (28.0%), adenomyosis (16.0%), polyp (12.0%), carcinoma (8.0%) and (4.0%) without detected abnormality.

Table (3): MRI diagnosis among the studied cases

Findings	N	%
Myoma	7	28.0
Adenomyosis	6	24.0
Polyp	5	20.0
Hypeplasia	4	16.0
Carcinoma	3	12.0

Table (3) shows that MRI diagnosis among the studied cases. myoma was the most frequent finding (28.0%), followed, adenomyosis (24.0%), polyp (5.0%), endometrial hyperplasia (16.0%) and carcinoma (12.0%).

Table (4): Final diagnosis (Hysteroscopy and biopsy histopathology) among the studied cases.

Findings	N	%
Myoma	7	28.0
Adenomyosis	6	24.0
Polyp	5	20.0
Hyperplasia	4	16.0
Carcinoma	3	12.0

Table (4) shows that Final diagnosis (Hysteroscopy and biopsy histopathology) among the studied cases. myoma was the most frequent finding (28.0%), followed, adenomyosis (24.0%), polyp (5.0%), endometrial hyperplasia (16.0%) and carcinoma (12.0%).

Table (5): Agreement between US diagnosis and final diagnosis regarding overall diagnosis

Final diagnosis	US diagnosis					
	Myoma	Adenomyosis	Polyp	Hypeplasia	Carcinoma	NAD
Myoma	5 (71.4%)	0 (0.0%)	1 (33.3%)	1 (12.5%)	0 (0.0%)	0 (0.0%)
Adenomyosis	1 (14.3%)	4 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0%)
Polyp	1 (14.3%)	0 (0.0%)	2 (66.7%)	2 (25.0%)	0 (0.0%)	0 (0.0%)
Hypeplasia	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (50.0%)	0 (0.0%)	0 (0.0%)
Carcinoma	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (12.5%)	2 (100.0%)	0 (0.0%)
Total			3	8	2	1
Kappa	7	4	<0.001*			

NAD: No abnormality detected Percentages were from the US diagnosis. Kappa test. *Significant

Table (5) shows that There was statistically significant moderate agreement between US diagnosis and final diagnosis regarding overall diagnosis.

Table (6): Agreement between MRI diagnosis and final diagnosis regarding overall diagnosis.

Final diagnosis	MRI diagnosis				
	Myoma	Adenomyosis	Polyp	Hypeplasia	Carcinoma
Myoma	7 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Adenomyosis	0 (0.0%)	6 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Polyp	0 (0.0%)	0 (0.0%)	5 (100.0%)	0 (0.0%)	0 (0.0%)
Hypeplasia	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (100.0%)	0 (0.0%)
Carcinoma	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (100.0%)
Total	7	6	5	4	3
Kappa	1.000	P-value	<0.001*		

Table (6) shows there was statistically significant perfect agreement between MRI diagnosis and final diagnosis regarding overall diagnosis

Table (7): Agreement between US diagnosis and MRI diagnosis regarding overall diagnosis

MRI diagnosis	US diagnosis					
	Myoma	Adenomyosis	Polyp	Hypeplasia	Carcinoma	NAD
Myoma	5 (71.4%)	0 (0.0%)	1 (33.3%)	1 (12.5%)	0 (0.0%)	0 (0.0%)
Adenomyosis	1 (14.3%)	4 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0%)
Polyp	1 (14.3%)	0 (0.0%)	2 (66.7%)	2 (25.0%)	0 (0.0%)	0 (0.0%)
Hypeplasia	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (50.0%)	0 (0.0%)	0 (0.0%)
Carcinoma	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (12.5%)	2 (100.0%)	0 (0.0%)
Total	7	4	3	8	2	1
Kappa	0.599	P-value	<0.001*			

Table (7) shows there was statistically significant moderate agreement between MRI diagnosis and final diagnosis regarding overall diagnosis.

Table (8): Agreement between each of US and MRI with final diagnosis (reference) diagnoses regarding myoma detection.

US diagnosis	Final diagnosis		
	Myoma	No myoma	
Myoma	5 (20.0%) TP	2 (8.0%) FP	
No myoma	2 (8.0%) FN	16 (32.0%) TN	
Kappa	0.603	P-value	0.003*
MRI diagnosis	Final diagnosis		
	Myoma	No myoma	
Myoma	7 (28.0%) TP	0 (0.0%) FP	
No myoma	0 (0.0%) FN	18 (72.0%) TN	
Kappa	1.000	P-value	<0.001*
US diagnosis	MRI diagnosis		
	Myoma	No myoma	
Myoma	5 (20.0%)	2 (8.0%)	
No myoma	2 (8.0%)	16 (32.0%)	
Kappa	0.603	P-value	0.603

Percentages are from the total (25), **TP**: True positive, **TN**: True negative, **FP**: False positive, **FN**: False negative

Table (9) shows that regarding myoma, the agreement between final diagnosis and MRI diagnosis was perfect. The agreement between final diagnosis and US diagnosis was moderate. The agreement between US and MRI diagnosis was moderate.

Table (9): Diagnostic characteristics of US and MRI in the detection of myoma.

Characteristics	US		MRI	
	Value	95% CI	Value	95% CI
Sensitivity	71.4%	29.0%–96.3%	100.0%	59.0%–100.0%
Specificity	88.9%	65.3%–98.6%	100.0%	81.5%–100.0%
Diagnostic accuracy	84.0%	63.9%–95.5%	100.0%	86.3%–100.0%
Youden's index	60.3%	23.8%–96.8%	100.0%	100.0%–100.0%
Positive Predictive value	71.4%	29.0%–96.3%	100.0%	59.0%–100.0%
Negative Predictive value	88.9%	65.3%–98.6%	100.0%	81.5%–100.0%
Positive likelihood ratio	6.43	1.60–25.76	Infinity	Infinity–Infinity
Negative likelihood ratio	0.32	0.10–1.05	0.00	0.00–0.00
Diagnostic odds ratio	20.00	2.21–180.90	Infinity	Infinity–Infinity

Table (9) shows that in the diagnosis of myoma, MRI had perfect diagnostic characteristics, while US had moderate diagnostic characteristics.

Table (10): Agreement between each of US and MRI with final diagnosis (reference) diagnoses regarding adenomyosis detection.

US diagnosis	Final diagnosis		
	Adenomyosis	No adenomyosis	
Adenomyosis	4 (36.0%) TP	0 (0.0%) FP	
No adenomyosis	2 (4.0%) FN	19 (76.0%) TN	
Kappa	0.752	P-value	<0.001*
MRI diagnosis	Final diagnosis		
	Adenomyosis	No adenomyosis	
Adenomyosis	6 (36.0%) TP	0 (0.0%) FP	
No adenomyosis	0 (0.0%) FN	19 (76.0%) TN	
Kappa	1.000	P-value	<0.001*
US diagnosis	MRI diagnosis		
	Adenomyosis	No adenomyosis	
Adenomyosis	4 (36.0%)	0 (0.0%)	
No adenomyosis	2 (4.0%)	19 (76.0%)	
Kappa	0.752	P-value	<0.001*

Percentages are from the total (25), **TP**: True positive, **TN**: True negative, **FP**: False positive, **FN**: False negative

Table (10) shows that regarding adenomyosis, the agreement between final diagnosis and MRI diagnosis was perfect. The agreement between final diagnosis and US diagnosis was moderate. The agreement between US and MRI diagnosis was moderate.

Table (11): Diagnostic characteristics of US and MRI in the detection of adenomyosis

Characteristics	US		MRI	
	Value	95% CI	Value	95% CI
Sensitivity	66.7%	22.3%–95.7%	100.0%	54.1%–100.0%
Specificity	100.0%	82.4%–100.0%	100.0%	82.4%–100.0%
Diagnostic accuracy	92.0%	74.0%–99.0%	100.0%	86.3%–100.0%
Youden's index	66.7%	28.9%–100.0%	100.0%	100.0%–100.0%
Positive Predictive value	100.0%	39.8%–100.0%	100.0%	54.1%–100.0%
Negative Predictive value	90.5%	69.6%–98.8%	100.0%	82.4%–100.0%
Positive likelihood ratio	Infinity	Infinity–Infinity	Infinity	Infinity–Infinity
Negative likelihood ratio	0.33	0.11–1.03	0.00	0.00–0.00
Diagnostic odds ratio	Infinity	Infinity–Infinity	Infinity	Infinity–Infinity

Table (11) shows that in the diagnosis of adenomyosis, MRI had perfect diagnostic characteristics, while US had perfect specificity, negative predictive value and positive likelihood ratio, but low other diagnostic characteristics.

Table (12): Agreement between each of US and MRI with final diagnosis (reference) diagnoses regarding polyp detection.

US diagnosis	Final diagnosis		
	Polyp	No polyp	
Polyp	2 (8.0%) TP	1 (4.0%) FP	
No polyp	3 (12.0%) FN	19 (76%) TN	
Kappa	0.412	P-value	<0.001*
MRI diagnosis	Final diagnosis		
	Polyp	No polyp	
Polyp	5 (25.0%) TP	0 (0.0%) FP	
No polyp	0 (0.0%) FN	20 (80.0%) TN	
Kappa	1.000	P-value	<0.001*
US diagnosis	MRI diagnosis		
	Polyp	No polyp	
Polyp	2 (8.0%)	1 (4.0%)	
No polyp	3 (12.0%)	19 (76%)	
Kappa	0.412	P-value	<0.001*

Percentages are from the total (25), **TP**: True positive, **TN**: True negative, **FP**: False positive, **FN**: False negative

Table (12) shows that regarding polyp, the agreement between final diagnosis and MRI diagnosis was perfect. The agreement between final diagnosis and US diagnosis was moderate. The agreement between US and MRI diagnosis was moderate.

Table (13): Diagnostic characteristics of US and MRI in the detection of polyp.

Characteristics	US		MRI	
	Value	95% CI	Value	95% CI
Sensitivity	40.0%	5.3%–85.3%	100.0%	47.8%–100.0%
Specificity	95.0%	75.1%–99.9%	100.0%	83.2%–100.0%
Diagnostic accuracy	84.0%	63.9%–95.5%	100.0%	86.3%–100.0%
Youden's index	35.0%	-9.0%–79.0%	100.0%	100.0%–100.0%
Positive Predictive value	66.7%	9.4%–99.2%	100.0%	47.8%–100.0%
Negative Predictive value	86.4%	65.1%–97.1%	100.0%	83.2%–100.0%
Positive likelihood ratio	8.00	0.89–71.58	Infinity	Infinity–Infinity
Negative likelihood ratio	0.63	0.31–1.30	0.00	0.00–0.00
Diagnostic odds ratio	12.67	0.86–186.91	Infinity	Infinity–Infinity

Table (13) shows that in the diagnosis of polyp, MRI had perfect diagnostic characteristics, while US had high specificity, negative predictive value and positive likelihood ratio, but low other diagnostic characteristics.

Table (14): Agreement between each of US and MRI with final diagnosis (reference) diagnoses regarding endometrial hyperplasia detection.

US diagnosis	Final diagnosis		
	Hyperplasia	No hyperplasia	
Hyperplasia	4 (16.0%) TP	4 (16.0%) FP	
No hyperplasia	0 (0.0%) FN	17 (68.0%) TN	
Kappa	0.676	P-value	<0.001*
MRI diagnosis	Final diagnosis		
	Hyperplasia	No hyperplasia	
Hyperplasia	4 (16.0%) TP	0 (0.0%) FP	
No hyperplasia	0 (0.0%) FN	21 (84.0%) TN	
Kappa	1.000	P-value	<0.001*
US diagnosis	MRI diagnosis		
	Hyperplasia	No hyperplasia	
Hyperplasia	4 (16.0%)	4 (16.0%)	
No hyperplasia	0 (0.0%)	17 (68.0%)	
Kappa	0.676	P-value	<0.001*

Percentages are from the total (25), **TP**: True positive, **TN**: True negative, **FP**: False positive, **FN**: False negative

Table (14) shows that regarding endometrial hyperplasia, the agreement between final diagnosis and MRI diagnosis was perfect. The agreement between final diagnosis and US diagnosis was moderate. The agreement between US and MRI diagnosis was moderate.

Table (15): Diagnostic characteristics of US and MRI in the detection of endometrial hyperplasia.

Characteristics	US		MRI	
	Value	95% CI	Value	95% CI
Sensitivity	100.0%	39.8%–100.0%	100.0%	39.8%–100.0%
Specificity	81.0%	58.1%–94.6%	100.0%	83.9%–100.0%
Diagnostic accuracy	84.0%	63.9%–95.5%	100.0%	86.3%–100.0%
Youden's index	81.0%	64.2%–97.7%	100.0%	100.0%–100.0%
Positive Predictive value	50.0%	15.7%–84.3%	100.0%	39.8%–100.0%
Negative Predictive value	100.0%	80.5%–100.0%	100.0%	83.9%–100.0%
Positive likelihood ratio	5.25	2.17–12.68	Infinity	Infinity–Infinity
Negative likelihood ratio	0.00	0.00–0.00	0.00	0.00–0.00
Diagnostic odds ratio	Infinity	Infinity–Infinity	Infinity	Infinity–Infinity

Table (15) shows that in the diagnosis of endometrial hyperplasia, MRI had perfect diagnostic characteristics, while US had perfect sensitivity, negative predictive value and negative likelihood ratio, but moderate other diagnostic characteristics.

Table (16): Agreement between each of US and MRI with final diagnosis (reference) diagnoses regarding carcinoma detection.

US diagnosis	Final diagnosis		
	Carcinoma	No carcinoma	
Carcinoma	2 (8.0%) TP	0 (0.0%) FP	
No carcinoma	1 (4.0%) FN	22 (88.0%) TN	
Kappa	0.770	P-value	<0.001*
MRI diagnosis	Final diagnosis		
	Carcinoma	No carcinoma	
Carcinoma	3 (12.0%) TP	0 (0.0%) FP	
No carcinoma	0 (0.0%) FN	22 (88.0%) TN	
Kappa	1.000	P-value	<0.001*
US diagnosis	MRI diagnosis		
	Carcinoma	No carcinoma	
Carcinoma	2 (8.0%)	0 (0.0%)	
No carcinoma	1 (4.0%)	22 (88.0%)	
Kappa	0.770	P-value	<0.001*

Percentages are from the total (25), **TP**: True positive, **TN**: True negative, **FP**: False positive, **FN**: False negative

Table (16) shows that regarding carcinoma, the agreement between final diagnosis and MRI diagnosis was perfect. The agreement between final diagnosis and US diagnosis was moderate. The agreement between US and MRI diagnosis was moderate.

Table (17): Diagnostic characteristics of US and MRI in the detection of carcinoma.

Characteristics	US		MRI	
	Value	95% CI	Value	95% CI
Sensitivity	66.7%	9.4%–99.2%	100.0%	29.2%–100.0%
Specificity	100.0%	84.6%–100.0%	100.0%	84.6%–100.0%
Diagnostic accuracy	96.0%	79.6%–99.9%	100.0%	86.3%–100.0%
Youden's index	66.7%	13.3%–100.0%	100.0%	100.0%–100.0%
Positive Predictive value	100.0%	15.8%–100.0%	100.0%	29.2%–100.0%
Negative Predictive value	95.7%	78.1%–99.9%	100.0%	84.6%–100.0%
Positive likelihood ratio	Infinity	Infinity–Infinity	Infinity	Infinity–Infinity
Negative likelihood ratio	0.33	0.07–1.65	0.00	0.00–0.00
Diagnostic odds ratio	Infinity	Infinity–Infinity	Infinity	Infinity–Infinity

Table (17) shows that in the diagnosis of carcinoma, MRI had perfect diagnostic characteristics, while US had perfect specificity, negative predictive value and positive likelihood ratio, but low other diagnostic characteristics.

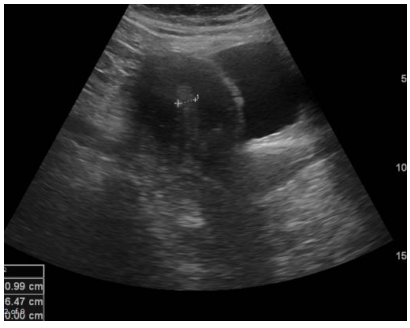
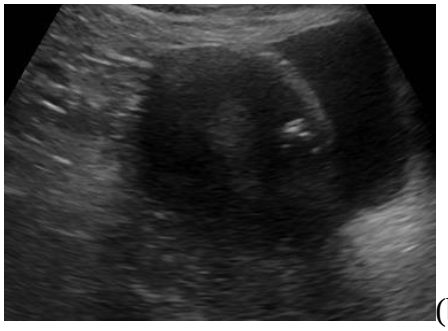
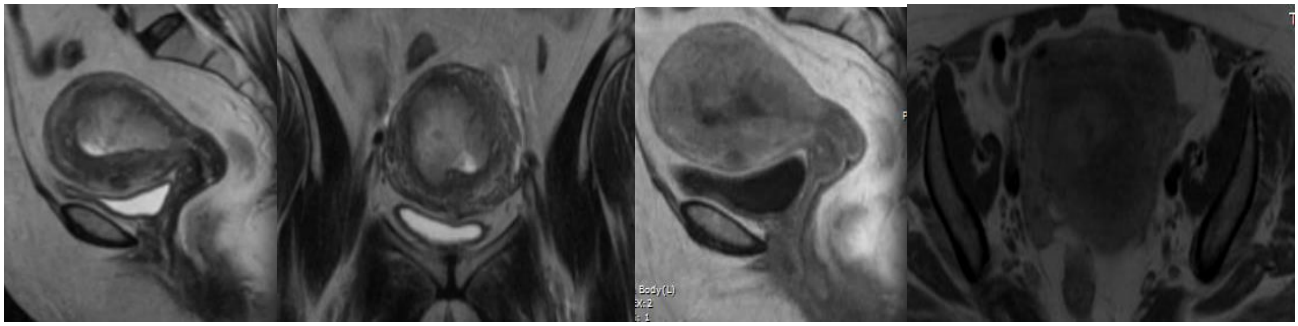

(a)

(b)

Figure (1): (a) Ultrasound images showing thick echogenic endometrium (9mm) and (b) calcified small uterine fibroid related to the anterior wall.



(a) (b) (c) (d)

Figure (2): Sagittal T2 (A), Coronal T2(B), Sagittal T1 with contrast (C) and axial T1 with contrast (D) MRI images showing thickening of the endometrium reaching about 4cm in thickness with heterogeneous enhancement and small intramural uterine fibroids. No enlarged pelvic iliac lymph nodes.

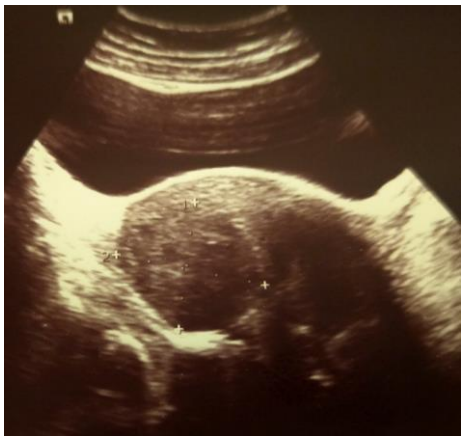
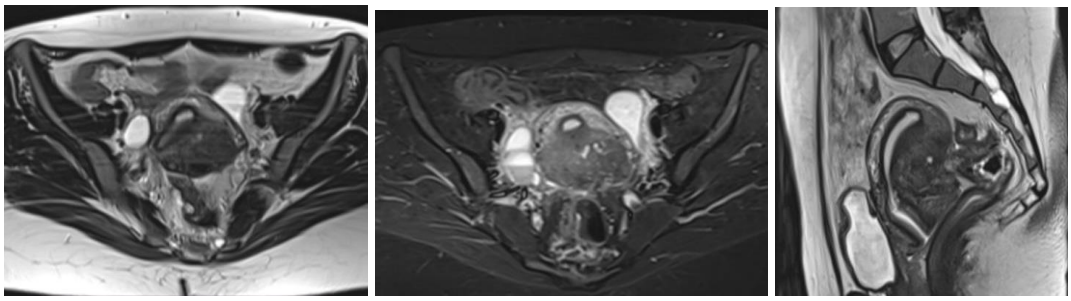


Figure (3): Ultrasound images showing well defined hypoechoic focal lesion seen at posterior uterine wall measures 4 x 5.5 cm



(a) **(b)** **(c)**

Figure (3): Axial T2, sagittal T2 & T1 postcontrast MRI images showing diffuse thickening of junctional zone at the posterior wall with embedded bright foci in T2WIs.the posterior wall signal alternation shows no enhancement following IV contrast administration (c) confirming the diagnosis of adenomyosis

DISCUSSION:

MRI appears to be an important modality in diagnosing uterine pathologies with an overall precision rate of 91-93% particularly when contrast techniques are used. MRI with its high resolution and multi

planar imaging has the capability to characterize multiple lesions and is becoming the modality of choice to assess the uterine pathologies [(3)].

Another widely used modality for evaluation of pelvic pathologies is USG. The advantages of USG are promptly available, reduced cost and its safety and simplicity of the examination. However, the drawbacks with this modality include limited field of view, obscuration of pelvis by bowel gas and its dependence on the skill expertise of the radiologists [(7)]. Up to a specific degree, transvaginal ultrasonography aids in diagnosing the lesion, but it is highly dependent on the skill of the operator and a few of lesions may get away from the field of view occasionally [*(8)*].

MRI is usually considered as a next step in the evaluation of a lesion after USG. The only drawback of MRI lies in, it not being readily available and expensive compared to USG. It also is not advisable for patients with certain metallic implants and claustrophobic patients [(3)].

Since diagnosis of uterine mass represents major conflict, comparing between MRI, transabdominal and transvaginal ultrasound for evaluation of uterine pathologies was highlighted as a main point of interest [(3)].

In this study, we aimed to compare the role of magnetic resonance imaging (MRI) and Ultrasound (trans-abdominal & trans-vaginal) in assessment of uterine mass lesions.

This prospective study was conducted at National Cancer Institute & International medical Center (Radiology department) from June 2019 till April 2021 and performed on total 25 female patients with uterine mass lesions.

During this study, 35 patients were assessed for eligibility and 25 patients were included in the study. Of all eligible patients, 8 patients were excluded from the study based on the inclusion criteria and 2 patients refused to participate in of the study.

Ultimately, the analysis was based on the data of 25 female patients with uterine mass lesions.

USG (TAS and TVUS) and MRI were performed on 25 patients who were referred to the Department of Radiology with clinically suspected uterine lesions. Patients were evaluated for uterine lesions in which USG and MRI was done and correlated.

All the patients in our study were sub-grouped into 5 categories based by Hysteroscopy and underlying histopathology: 1) Myomas: 7 patients (28%); 2) Adenomyosis: 6 patients (24%); 3) Polyp: 5 patients (20%); 4) Endometrial Hyperplasia: 4 patients (16%); 5) Uterine carcinoma: 3 patients (12%). Sensitivity and specificity were calculated for each modality in each subgroup and was compared.

The current study revealed that Ultrasonography among the studied cases detected that Endometrial hyperplasia was the most frequent finding (32.0%), followed by myoma (28.0%), adenomyosis (16.0%), polyp (12.0%), carcinoma (8.0%) and (4.0%) without detected abnormality.

However, MR evaluation among the studied cases detected that myoma was the most frequent finding (28.0%), followed, adenomyosis (24.0%), polyp (5.0%), endometrial hyperplasia (16.0%) and carcinoma (12.0%).

Hence, our results revealed that there was statistically significant perfect agreement between MRI evaluation and final diagnosis by hysteroscopy and histopathology regarding overall diagnosis of uterine lesions ***(p value<0.001)***.

Consequently, our study revealed that MR had sensitivity and specificity of 100% for diagnosis of all uterine lesions (uterine myomas, adenomyosis, polyp, hyperplasia and carcinoma).

These findings are in agreement with previous studies. ***Shankar et al.,*** [3] conducted a prospective study was done on 92 patients who were referred to radiology department with suspected uterine pathologies. All patients who had positive or suspicious USG findings were subjected to MRI examination. The comparison was made to compare MRI and USG in detection of uterine lesions and to compare MRI and USG in differentiation and characterization of uterine lesions with histopathology as gold standard.

Shankar et al., [3] revealed that out of 16 cases of adenomyosis detected by histopathology, MRI detected 12 (75%) as diffuse adenomyosis, two as adenomyosis with fibroid uterus and two as focal adenomyosis. On the other hand, USG detected six as adenomyosis six as bulky uterus with heterogeneous myometrium suspicious for adenomyosis or leiomyoma, two as focally thickened myometrium and two as bulky uterus with fibroid. Out of 16 cases USG could detect only six has adenomyosis and other 10 were suspicious for adenomyosis. In addition, four cases diagnosed by USG as adenomyosis turned out to be fibroid in MRI.

This explained that there is significant difference in diagnosing adenomyosis by USG and MRI ***(p=0.0001).***

Regarding myoma, ***Shankar et al.,*** [3] revealed that a total of 96 fibroids were diagnosed with MRI, where 48 intramural fibroids were noted, 12 submucosal fibroids were noted, 14 sub-serosal fibroids were noted and 10 of them were both submucosal and intramural and 12 were both sub-serosal and intramural. In comparison, USG detected 68 fibroids where 44 were found to be intramural, four were found to be submucosal, 10 were sub-serosal and eight of them were sub-serosal and intramural and two lesions were found in submucosal and intramural locations.

The main advantage with MR was of picking up additional number of fibroids. The main reason for reduced deduction of fibroids with USG was due to reduced pick up of submucosal fibroid by USG. Also, the average size of fibroid missed by USG was about 1 cm or less than it [3].

Also, ***Shankar et al.,*** [3] revealed that among 16 cases of adenomyosis MRI detected all cases (100%) with sensitivity, specificity, positive and negative predictive value about 100%.

Out of 12 patients four patients had endometrial carcinoma, two had hyperplasia and six had polyp on histopathology where two patients were diagnosed with endometrial carcinoma, four with hyperplasia and six patients with polyp on MR. The two patients were misdiagnosed on MR as hyperplasia as there were no signs of myometrial invasion. On USG six patients had thickened endometrium, four patients had polyp and two patients had suspicious polyp. Out of six patients with thickened endometrium one patient had features of myometrial invasion suggesting carcinoma.

Consequently, there is significant association between USG and MRI ***(p=0.0001)*** with respect to detection of fibroids. There was no discrepancy when only one fibroid was there. However, when more than one fibroid was present MRI was better than USG in detecting number of fibroids. Hence, MRI was taken as gold standard in cases of fibroid [3].

Tatikonda Venkat Kishan et al., [5] conducted a prospective study involving 50 female patients with complaints of lower abdominal pain and irregular bleeding were selected. These patients had undergone trans abdominal sonography (transvaginal when needed) and MRI pelvis imaging. Subsequently these findings were correlated with the histopathological findings, whenever needed.

Tatikonda Venkat Kishan et al., [5] revealed that the overall malignant lesions identified were 19 on histopathology, out of which 5 (true positive) were identified on USG and 14 (true positive) on MRI. Out of 31 definite benign lesions diagnosed on histopathology, 29 (true negative) were picked on USG and 31(true negative) on MRI. The study revealed a sensitivity of 26.3%, specificity of 93.5%, PPV of 80.3%, NPV of 55.9% and accuracy of 68% to ultrasonography and the same way a sensitivity of 73.6%, specificity of 100%, PPV of ∞, NPV of 79.1% and accuracy of 90% to MRI pelvis examination.

Hameed AM, [9] compared USG and MRI with pathology result for detection of fibroids. The correct detection rate of myoma in USG was low 73.3% and with MRI detection rate was 98.1% with significant ***(p=0.001)***. Mean number of myomas in US was 1.62±1.07, in MRI was 2.14±1.49 and in pathology was 2.15±1.5. The mean diameter of myomas in pathology was 3.49±2.21, in MRI was 3.58±2.21. Regarding myomas' localization, there is no significant difference between MRI and pathology but there was high significant difference in myomas' localization in US and pathology. The results were similar to our study where MRI was better than USG in detection of fibroids predominantly submucosal and small sized fibroids.

Devimeenal J et al., [6] compared the sensitivity and specificity of MRI, transabdominal, transvaginal sonography in detecting and characterizing the uterine mass lesions. For detection of myometrial mass lesions, the diagonal agreement between the transvaginal sonography and MRI was 96%. In classifying the site of myometrial mass lesions, the diagonal agreement between transvaginal sonography and MRI was 67%. The sensitivity of detecting adenomyosis in TAS, TVS and MRI respectively is 33%, 58% and 92% compared to 66.7% and 100% in our study for USG and MRI.

Levens ED et al., [7] conducted a study to compare magnetic resonance and ultrasound imaging to assess the diagnostic ability of MRI and US to locate and accurately measure uterine fibroids as part of clinical investigation for uterine fibroid measurement. Eighteen women undergoing hysterectomy for symptomatic fibroids underwent preoperative pelvic ultrasound and magnetic resonance imaging. Resected fibroids were correlated with the images.

Levens ED et al., [7] revealed that the sensitivity of MRI was 2-fold greater than US for the detection of uterine fibroids (MRI, 80%; US, 40%) using pathologic specimens as the gold standard compared to our results (MRI, 100%; US, 71.4%) and suggested that MRI be considered as the best modality for the detection of uterine fibroids in clinical research, especially considering its superior ability to detect smaller lesions. Moreover, because of its superior sensitivity, MRI may likewise be considered as the preferred imaging modality if invasive interventions such as surgical treatment, uterine artery embolization, or focused US are being entertained.

Ascher SM et al., [10] conducted a prospective study on 20 women with clinically suspected adenomyosis who underwent MRI and transvaginal sonography. The correct diagnosis was achieved with MRI in 15 out of 17 cases whereas nine out of 17 cases were diagnosed with transvaginal sonography. They concluded that MRI is significantly better than transvaginal sonography ***(p<0.02).***

Also, ***Togashi K et al.,*** [11] conducted a study on 93 patients, among them 71 had fibroid, 16 had adenomyosis, six had both fibroid and adenomyosis. MR diagnosis was correlated with surgical/pathologic findings. The cause of uterine enlargement was correctly diagnosed in MR images in 92 of the 93 cases and concluded that MRI is highly accurate in helping to distinguish

between adenomyosis and leiomyoma in cases of enlarged uterus.

In contrast to our study, ***Hashad AM et al.,*** [8] did study on 77 patients where 67 (87%) were positive for adenomyosis by 3D TVUS, confirmed in 46 (59.74%) by histopathology, while 52 (67.53%) were positive by MRI, confirmed in 39 (50.64%) by histopathology. A 3D transvaginal sonography was able to diagnose adenomyosis in 67 (87%) patients, while MRI was able to diagnose adenomyosis in 52 (67.5%) patients. They concluded that 3D transvaginal USG is highly accurate as MRI in diagnosing adenomyosis. In contrary in our study MRI was better than transvaginal ultrasonography for diagnosis of adenomyosis, however in our study we had used 2D sonography.

Also, ***Bazot M et al.,*** [12] conducted a prospective study on 120 patients to compare the accuracy of transabdominal, transvaginal sonography and MRI for the diagnosis of adenomyosis. Sensitivity, specificity and positive and negative predictive values of MRI were 77.5, 92.5, 83.8 and 89.2% respectively. The sensitivity, specificity and positive and negative predictive value of transabdominal, transvaginal sonography were 32.5 and 65.0%, 95.0 and 97.5%, 76.4 and 92.8% and 73.8 and 88.8%. They concluded that transvaginal sonography is as efficient as MRI for the diagnosis of adenomyosis in women without myoma, while MRI could be recommended for women with associated leiomyoma.

The strength points of this study are that it is prospective study design, evaluation of three different diagnostic methods and having no patients lost to follow-up.

The limitations of the study are worthy of mention including relatively smaller sample size relative to the previous studies, not being a multicentric study and this represents a significant risk of publication bias. Another limitation is lack of transvaginal sonography study in unmarried women and presence of Covid-19 pandemic which limited the availability of patients. Another limitation of USG is limited field of view, obesity, bowel gas, requirement of full bladder, few of the factors that may hamper the diagnosis.

Conclusion

MRI study helped in accurate detection of the lesions and further characterization of lesions correctly identified by ultrasound such as site of origin, degenerative changes in a fibroid and extent of malignant mass.

MRI has a sensitivity of 100% with a superior modality and it can overcome the difficulties faced by ultrasound and can help in accurate diagnosis with detailed characterization of the lesions. In the staging of mass lesions, it remains the investigation of choice.

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تقييم أورام الرحم بالتصوير المغناطيسى بالمقارنة بالموجات فوق الصوتية عن طريق البطن والمهبل

الخلفيه :نمو الرحم هو تضخم في أنسجة رحم الأنثى. يمكن أن يكون سبب نمو الرحم إما ظروف غير ضارة أو خطيرة. أحيانًا يُشار إلى حالات النمو طبياً على أنها كتل أو أورام. مثال على نمو غير ضار (حميد أو غير سرطاني) ، والذي لا يشكل تهديدًا ، هو ورم في عنق الرحم. بعض حالات النمو ، مثل الأورام الليفية الرحمية ، حميدة ، لكنها لا تزال تسبب بعض المشاكل المزعجة ، مثل النزيف. تشمل حالات النمو الخطيرة للرحم الأورام السرطانية (الخبيثة).

الهدف :مقارنه نتائج التصوير بالرنين المغناطيسى بالموجات فوق الصوتيه عبر البطن وعبر المهبل فى تقييم اورام الرحم

الطرق : أجريت هذه الدراسة المستقبلية في مستشفيات جامعه عين شمس والمركز الطبي العالمى (قسم الأشعة) وأجريت على إجمالي ٢٥ مريضة مصابات بآفات في الرحم.

خلال هذه الدراسة ، تم تقييم ٣٥ مريضا من حيث الأهلية وشمل ٢٥ مريضا في الدراسة. من بين جميع المرضى المؤهلين ، تم استبعاد ٨ مرضى من الدراسة بناءً على معايير الاشتمال ورفض مريضان المشاركة في الدراسة.

في النهاية ، اعتمد التحليل على بيانات ٢٥ مريضة مصابات بآفات في كتلة الرحم.

تم إجراء التصوير بالموجات فوق الصوتية والرنين المغناطيسي على ٢٥ مريضًا تم تحويلهم إلى قسم الأشعة مع وجود آفات رحمية مشتبه بها إكلينيكيًا. تم تقييم المرضى من أجل آفات الرحم حيث تم إجراء التصوير بالموجات فوق الصوتية والرنين المغناطيسي وربطهما.

النتائج : كشفت الدراسة الحالية أن التصوير بالموجات فوق الصوتية من بين الحالات المدروسة كشف عن أن تضخم بطانة الرحم كان الأكثر شيوعًا (٣٢.٠٪) ، يليه الورم العضلي (٢٨.٠٪) ، العضال الغدي (١٦.٠٪) ، السلائل (١٢.٠٪) ، السرطان (٨.٠٪) ، و (٤.٠٪) بدون اكتشاف عيوب.

ومع ذلك ، أظهر تقييم الرنين المغناطيسي بين الحالات المدروسة أن الورم العضلي كان الأكثر شيوعًا (٢٨.٠٪) ، يليه ، العضال الغدي (٢٤.٠٪) ، السليلة (٥.٠٪) ، تضخم بطانة الرحم (١٦.٠٪) ، والسرطان (١٢.٠٪).

ومن ثم ، كشفت نتائجنا عن وجود اتفاق مثالي ذي دلالة إحصائية بين تقييم التصوير بالرنين المغناطيسي والتشخيص النهائي عن طريق تنظير الرحم وعلم أمراض الأنسجة فيما يتعلق بالتشخيص العام لآفات الرحم.

وبالتالي ، كشفت دراستنا أن الرنين المغناطيسي له حساسية وخصوصية بنسبة ١٠٠٪ لتشخيص جميع آفات الرحم (الورم العضلي الرحمي ، والعضال الغدي ، والزوائد اللحمية ، وتضخم التنسج ، والسرطان).

الخلاصه : خلصنا إلى أن دراسة التصوير بالرنين المغناطيسي ساعدت في الكشف الدقيق عن الآفات وزيادة توصيف الآفات التي تم تحديدها بشكل صحيح بواسطة الموجات فوق الصوتية مثل موقع المنشأ والتغيرات التنكسية في الورم الليفي ومدى الكتلة الخبيثة.

التصوير بالرنين المغناطيسي لديه حساسية بنسبة ١٠٠٪ بطريقة متفوقة ويمكنه التغلب على الصعوبات التي تواجهها الموجات فوق الصوتية ويمكن أن يساعد في التشخيص الدقيق مع التوصيف التفصيلي للآفات. في تنظيم الآفات الجماعية ، يبقى التحقيق المختار.