

Original Research Article

# A Comparative Study of Ultrasonography and Magnetic Resonance Imaging in the Diagnosis of Adnexal Lesions


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## Abstract

**Introduction:** Adnexal mass lesions are common among women which has a prevalence of 0.17%-5.9% in asymptomatic women and 7.1%-12% in symptomatic women of all ages. Diagnosing the malignancy at early stage is difficult among adnexal masses. Early intervention and management can save many women in reproductive age group with good outcome.

**Aim:** To find out the validity of Ultrasonography (USG) and Magnetic Resonance Imaging (MRI) in evaluation of uterine adnexal masses.

**Materials and methods:** A Cross-sectional study of 45 subjects with suspected various adnexal masses over a period of one year from November 2019 to November 2020 in the Department of Radiodiagnosis and Obstetrics and Gynecology, were included. The data was entered in master chart then analysed using Statistical Package for the Social Sciences (SPSS) 19. Chi-square test has been used to compare the sensitivity of Tran abdominal Ultrasound (TAUS) and MRI scan with level of significance of <0.05. Predictive accuracy was measured using ROC curve.

**Results:** The subject's age ranged from 16 to 76 years with a mean age of 37.64. Ovary was the most common site of origin of adnexal masses. Most common adnexal masses on HPE were serious cystadenocarcinoma in malignant cases. USG showed an overall sensitivity of 58.3%, specificity of 100% PPV-100% and NPV-86.8% in comparison to the histopathological examination (HPE). Sensitivity, Specificity, PPV, NPV of MRI was 91.7%, 100%, 100% and 97.1%, respectively.

**Conclusion:** USG is the initial choice of imaging modality for evaluation of adnexal mass lesions. But imaging with MRI has high accuracy in identifying the origin of a mass, characterising its tissue content, Vascularity, Septal Thickness used in staging and preoperative plan. Sensitivity and diagnostic accuracy for MRI is higher than USG.

## Key words

Ultrasonography, Histopathological examination, Malignancy, Vascularity.

## Introduction

Adnexal mass is a lump arising from structures closely related to uterus such as fallopian tube, ovaries and surrounding connective tissue. Adnexal mass can be benign or malignant [1].

Ovarian malignancy is one of the most common causes of death from gynecologic tumors. Ovarian neoplasm is very rarely detected in early stage and it is far advanced at the time of diagnosis. Detection of ovarian tumor at very advanced stages makes the treatment very difficult [2]. Incidence of ovarian carcinoma is increasing in recent times. Ovarian ca is responsible for 3.6 % of all cancer cases, with a mortality of 4.3% [1].

Ultrasonography (US), Computed Tomography (CT), and Magnetic Resonance Imaging (MRI) can be used to evaluate ovarian mass. The first imaging modality for characterization of adnexal mass lesion is Ultrasonogram [3]. Investigation of choice for adnexal mass is MRI because it gives a better spatial and contrast resolution in delineation of anatomical structures as well as characterization of pathological lesions. MRI well delineates the abnormalities in female reproductive organs disorders including myomas, ovarian mass lesions, adenomyosis, cervical lesions, endometrial malignancy etc. [4].

Thus this study was conducted to compare diagnostic accuracy of the adnexal mass lesions on Ultrasonogram and MRI compared with Histopathology.

## Materials and methods

The present study was cross-sectional study which included 45 patients presenting with lower

abdominal pain and menstrual irregularities who were referred to Radiology Department with suspected adnexal mass. The study was conducted after getting approval from the Institution's Ethical Committee in Government Thiruvavur Medical College, Thiruvavur, Tamil Nadu. The study was conducted for one year, from period of November 2019 to November 2020, in the Department of Radiodiagnosis and obstetrics and Gynecology. Study population was patients with clinically suspected uterine adnexal masses referred to the Radiodiagnosis Department for USG. Those patients who had positive or suspicious findings in USG were subjected to MRI examination. The study was conducted after obtaining proper informed consent from the patient. Final correlation with histopathology was done in available subjects.

**Inclusion criteria:** Clinically suspected cases of uterine adnexal mass lesions and adnexal mass lesions found incidentally on USG.

### Exclusion criteria:

- All midline uterine mass lesions.
- Clinically and sonologically proved cases of ectopic pregnancy.
- All patients having cardiac pacemakers, prosthetic heart valves, cochlear implants or any metallic implants.
- Patients having history of claustrophobia.
- Patients not willing to participate in the study.

### Sample size Estimation:

In our study we included 45 patients which was calculated using the formula below,

In an equation,

Sample size (n) based on specificity =  $Z^2 \cdot 1 - a / 2 \times SN \times (1 - SN) / L^2$

Where, L (error) = 10% of sensitivity = 10% of 91 = 9.1

$$Z^2 \cdot 1 - \alpha = (1.96)^2 = 3.84$$

Sensitivity of MRI for adnexal mass = 91% [5]

Applying the above values in this formula,

$$n = 3.84 \times 91 \times (100 - 91)$$

$$= 3144.96 / 9.12 = 37.97 = 40$$

Considering, 10% non-response rate = 10% of 40 = 4

Therefore, total patients = 40 + 4 = 44

In an equation  $n = Z^2 \cdot 1 - \alpha (\text{sensitivity}) \cdot (1 - \text{sensitivity}) / L^2$

where, L (error) = 10% of sensitivity = 10% of 90 = 9

$$Z^2 \cdot 1 - \alpha = (1.96)^2 = 3.84$$

Sensitivity of USG for adnexal mass = 90% [6].

Applying the above values in this formula,

$$n = 3.84 \times 90 \times (100 - 90) = 3110.40 / 92 = 44$$

Considering, 10% non response rate = 10% of 44 = 4.4.

Therefore, total Patients = 44 + 4 = 48.

Considering, 44 cases to be the minimum number for statistical significance, 45 cases were examined during this period.

### Procedure of the study:

All the patients in the study were clinically evaluated by taking detailed history and clinical examination as per the clinical proforma. Selected cases fulfilling the criteria included in the study once after their consent had been taken. All the cases were done with ultrasonographic evaluation to determine the etiology of the adnexal masses and the findings were incorporated as per the proforma guidelines. All the patients then underwent MRI to assess the etiology of the disease process and the findings were incorporated in the proforma. The need of surgical treatment was evaluated among the patients. The data was recorded during the investigation procedure and compared with the operative and FNAC findings or HPE.

### Statistical analysis

The collected data were analysed with IBM.SPSS statistics software 19.0 Version.

To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables.

The Receiver Operator Characteristic (ROC) curve analysis was used to find the Sensitivity, Specificity, PPV and NPV on comparison of USG and MRI with HPE. In the above statistical tool the probability value <0.05 was considered as significant level.

### Results

Our study population consists of 45 patients who were evaluated in Obstetrics and Gynecology department and referred to Radiology Department.

The age group examined in our study was from 16-76 years. Among these the incidence of adnexal lesions were found to be more 35.6% in the age group of 36-45 years and followed by 24.4% in age group of 26-35 years (**Table - 1**).

**Table - 1:** Distribution of age.

Age	Frequency	Percent
<25 yrs	8	17.8
26 - 35 yrs	11	24.4
36 - 45 yrs	16	35.6
46 - 55 yrs	8	17.8
>55 yrs	2	4.4
Total	45	100.0

Mean age group of my study population was 37.64 years (**Table - 2**).

The study included 45 patients with adnexal mass lesions. On Ultra sonogram there were 38 cases of benign ovarian lesions and 7 cases of malignant ovarian tumors. MR imaging studies of 45 patients showed 33 cases to be of benign nature and 11 cases to be of malignant nature. Histopathological studies of postoperative specimen have revealed 33 cases to have benign

tumor and 12 cases to have malignant features (Table – 3).

In Ultra sonogram adnexal lesions solid cystic nature of the lesion was seen in 15.6% (5 cases), Septal thickness > 3mm in 7 cases, nodularity

was seen in 11.6% (5 cases) and central / septal vascularity was seen in 26.7% (12cases). Among these, all the cases having central and septal vascularity were found to be malignant (Table - 4).

**Table - 2:** Mean Distribution of Parameters.

Characteristics	N	Minimum	Maximum	Mean	Std. Deviation
Age	45	16	76	37.64	12.617
Thickness USG	26()	2	4	2.9	0.56
RI USG	27()	0.4	0.9	0.68	0.16
Thickness MRI	26()	2	4	3.3	0.56

**Table - 3:** Distribution of Septal Thickness in Various Diagnostic Modalities.

	USG	MRI	HPE	P Value
	N (%)	N (%)	N (%)	
Malignant	7 (15.5)	11 (24.5)	12 (26.6)	>0.05
Benign	38 (84.5)	34 (75.5)	33 (73.4)	

P value > 0.05 not significant by applying Chi Square Test

**Table - 4:** Comparison of lesion in USG with Histopathology.

		HPE		P value
		Malignant	Benign	
USG	Malignant	7	0	<0.05*
	Benign	5	33	
Total		12	33	

**Table - 5:** Comparison of lesion in MRI with Histopathology.

		HPE		P value
		Malignant	Benign	
MRI	Malignant	11	0	<0.05*
	Benign	1	33	
Total		12	33	

**Table - 6:** Diagnostic accuracy of USG and MRI in detecting Adnexal mass lesion.

	USG	MRI
Sensitivity	58.3	91.7
Specificity	100	100
PPV	100	100
NPV	86.8	97.1
Over all Accuracy	79.15	95.8

The Dynamic MR imaging features Solid – cystic nature of the lesion was seen in 15.6% (5 cases), septal thickness >3 mm was seen in 11

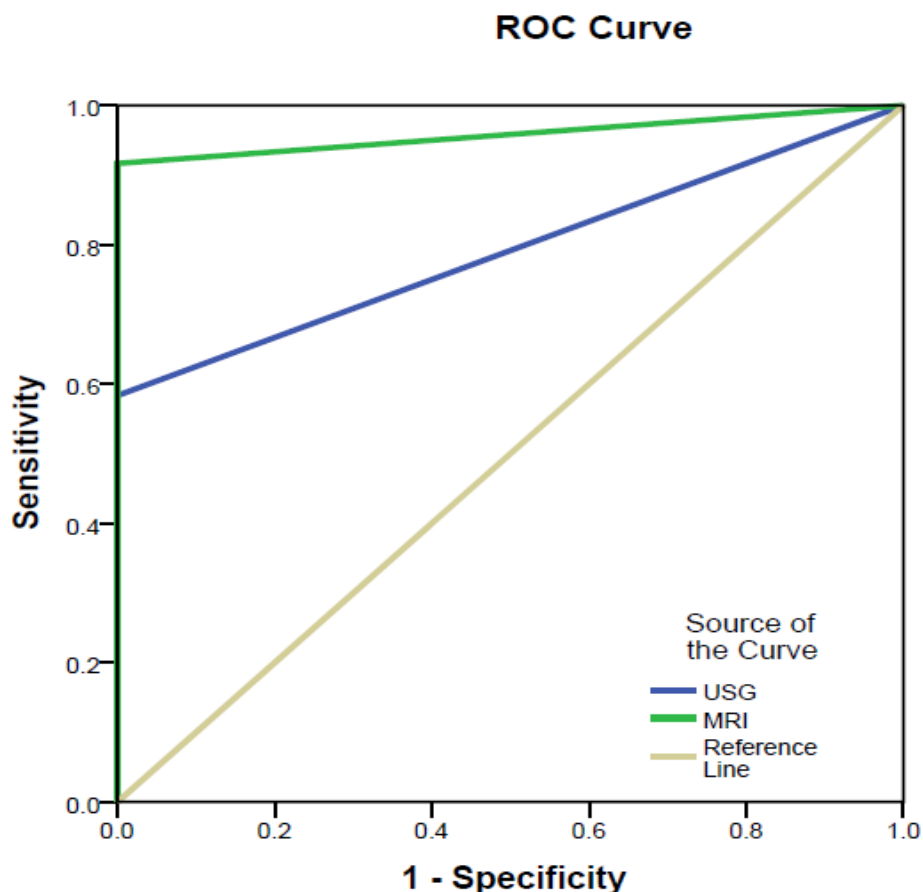
cases, nodularity was seen in 15.6% and early arterial phase enhancement was seen in 26.7%

(11 case) are highly indicative of malignant ovarian tumors.

Final results showed that out of 45 patients on HPE 12 patients had malignant lesion and 33 patients had benign lesion. Out of 12 malignant patients, MRI correctly diagnosed 11 cases and

one patient as falsely diagnosed as having benign lesion. USG correctly diagnosed 7cases out of 12 malignant cases and 5 cases were falsely diagnosed as having benign cases. Thirty three cases were diagnosed as benign lesion on HPE (Table – 5).

### Receiver Operating Characteristic Curve



**Figure - 1:** ROC curve showing Area under curve, Sensitivity, Specificity, PPV and NPV on comparison of USG and MRI with HPE.

Test Result Variable(s)	Area	Std. Error	P value	Asymptomatic 95% Confidence Interval	
				Lower Bound	Upper Bound
USG	.792	.092	0.003	.611	.973
MRI	.958	.047	.000	.866	1.000

P- Value is highly significant <0.01

The sensitivity, specificity, positive predictive value, negative predictive value, diagnostic accuracy of Ultrasonogram in comparison with HPE were 58.3%, 100%, 100%, 86.8%, 79.15% respectively (Table – 6).

ROC curve is as per Figure – 1. In comparison with HPE, characterization of the detected lesions as malignant, MR imaging had a sensitivity of 91.7%, specificity of 100%, positive predictive value of 100%, a negative

predictive value of 97.1%, and an overall accuracy of 95.8%.

Most common tumors in our study was Benign serous cystadenoma 44.4% followed by Benign mucinous cystadenoma 28.9, Malignant mucinous cystadenocarcinoma 11.1%, Serous papillary cystadenocarcinoma 11.1% (**Table – 7**).

**Table - 7:** Distribution of Outcome.

Ovarian Tumors	Frequency	%
Benign serous cystadenoma	20	44.4
Benign mucinous cystadenoma	13	28.9
Surface epithelial carcinoma of ovary	2	4.4
Malignant mucinous cystadenocarcinoma	5	11.1
Serous papillary cystadenocarcinoma	5	11.1

## Discussion

Our study included 45 patients with adnexal mass lesions who underwent ultrasonogram followed by MRI imaging. The MRI characterization of adnexal mass lesions, enhancement of lesion, septal thickness >3 mm, nodularity of the lesion and ascites are highly suggestive of malignant nature of the lesion.

Sohaib, et al. [7] showed that from the analysis of the MR imaging features, “the most predictive characteristics of malignancy are vegetations/nodule in a cystic lesion, presence of ascites, a maximal diameter greater than 6 cm, and necrosis in a solid lesion”, in the same way our study also shows the presence of nodules in a cystic lesion, presence of ascites and lesion size more than 6 cm suggestive of malignancy.

Valentini, et al. [8] suggested criteria for characterization of suspicious adnexal lesions. Features suggestive of malignancy as per

the valentine et al study were “solid, solid/cystic enhancing masses (greater than 4 cm in maximum diameter) with papillary projections and irregular thick wall and septa greater than 3 mm) into a cystic lesion” as well as a “heterogeneous and early enhancement pattern”. Similar to this study, the above features in our study population also had positivity for malignancy in HPE.

Adumusili, et al. [9] study have high specificity (94%) for establishing a benign diagnosis. The specificity in our study is 100%.

Guerra, et al. study [10] on MRI had a higher accuracy of 95% in differentiating between malignant and non-malignant adnexal lesions. The diagnostic accuracy of our study is 95% similar to Guerra, et al.

Adumusili, et al. study [9] showed Sonographically indeterminate ovarian mass lesions evaluated with MRI had a sensitivity and specificity of 100% and 94%, respectively. Result of our study MRI had a sensitivity of 91.7% and specificity of 100%.

Sohaib, et al. study [7] showed overall diagnostic accuracy of 91% for distinguishing MR imaging features of benign from malignant adnexal lesions. The results of our study show that the overall diagnostic accuracy of 95% for distinguishing benign from malignant adnexal lesions.

In our study the sensitivity, specificity, positive predictive value, negative predictive value, diagnostic accuracy of Ultrasonogram in comparison with HPE were 58.3%, 100%, 100%, 86.8.5%, 79.15% respectively. In comparison with HPE, characterization of the detected lesions as malignant, MR imaging had a sensitivity of 91.7%, specificity of 100%, positive predictive value of 100%, a negative predictive value of 97.1%, and an overall accuracy of 95.8%.



The results were consistent with the study conducted by Mugheri FN and Majeed AI [11], and Kasim A, et al. [12] to compare the diagnostic accuracy of doppler USG and contrast enhanced MRI, to characterize the adnexal masses into benign and malignant. The study showed that contrast enhanced MRI was more accurate investigation as compared to transabdominal doppler USG for differentiating the malignant and benign adnexal masses. The sensitivity, specificity, PPV, NPV and diagnostic accuracy of transabdominal USG in assessing adnexal masses were 85.18%, 80.56%, 86.79%, 78.38% and 83.33% respectively while for contrast enhanced MRI were 94.83%, 87.50%, 93.22%, and 92.22% respectively.

Sultana N, et al. studied and found that the sensitivity, specificity, PPV and NPV of transabdominal USG in assessing adnexal masses was 100%, 54%, 58.5% and 100%, respectively while for contrast enhanced MRI, was 95.8%, 86.4%, 82.1% and 96.9% respectively [13]. According to Abbas TR, et al., Transabdominal ultrasound had a sensitivity of 77%, specificity of 86.8%, and PPV of 85.3% and NPV of 81.9% [14]. In our study we had better sensitivity and specificity than these two studies.

### **Histopathological patterns**

In present study, serous cystadenoma was found to be the most common benign histological type representing 44.4% of the study group. According to Arora M, et al., Serous cystadenocarcinoma was the single most common histological entity with 36.53% prevalence and a striking predominance in post-menopausal patients [15].

### **Conclusion**

In spite of development in advanced chemotherapy regimens and improved surgical approaches, ovarian carcinoma continues to be one of the leading causes of death from gynecological malignancy. Treatment of adnexal mass lesion mandates stratification of risk based on imaging appearance of the mass.

Ultrasonography is the initial imaging modality of choice for evaluation of adnexal mass lesions. But evaluation with MRI is highly accurate for identifying the origin of a mass, characterizing its tissue content and staging & preoperative plan. Sensitivity and diagnostic accuracy for MRI is higher than USG. MRI is superior to Ultrasonogram in diagnosing and characterizing adnexal mass lesions. High accuracy of MRI contributes to preoperative planning of a sonographically indeterminate mass.

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