E-ISSN2250-0944
ISSN2250-1150
doi:10.31838/ijprt/16.01.721

Research Article

A COMPARATIVE STUDY BETWEEN ULTRASOUND AND MRI IN CHARACTERIZATION OF ADNEXAL MASSES BY O-RADS

Sake Vinod Kumar[1*], Tejaswini Mogalagunta[2]

[1]Assistant Professor, Department of Radiology, Kurnool Medical College, Kurnool.

[2]Assistant professor, Department of Radiology, Kurnool Medical College, Kurnool.

Corresponding Author: Sake Vinod Kumar

[1]Assistant Professor, Department of Radiology, Kurnool Medical College, Kurnool.

Date received: 10-05-2026, Date of acceptance: 15-05-2026, Date of publication: 20-05-2026.

Abstract

Introduction: Ovarian cancer is the leading cause of death among gynecological malignancies. The five-year survival rate for those diagnosed with ovarian cancer is 47%. Imaging adnexa can aid in detecting malignant tumors, hence encouraging timely surgical intervention to improve survival chances. This purpose must align with efforts to limit surgical and other invasive interventions for benign lesions. Thus, precise differentiation between malignant and benign adnexal lesions is essential for identifying the most successful treatment strategies.

Materials and methods: Following the approval of the institutional Ethics committee, all patients included in the study will be informed about the procedure, and informed permission will be secured. A thorough history assessment and screening for clips, metallic implants, and other pertinent criteria will be performed for all patients. All patients will have transabdominal and transvaginal sonography with the ESOATE MyLab system. Adnexal lesions will be evaluated in the ultrasonogram for several attributes, including dimensions, composition, vascularity, papillary projections, septations, and the presence of ascites.

Results: A total of 50 female patients were enrolled in the study. The mean age of participants in our study was 31.24 ± 10.45 years with a range of 19 to 60 years. The majority of patients (n=36, 72.0%) were premenopausal and14 (28%) were post-menopausal.

Conclusion: The study demonstrates a strong correlation between ultrasound (USG) and magnetic resonance imaging (MRI) in categorizing adnexal lesions using the Ovarian-Adnexal Reporting and Data System (O-RADS), with MRI enhancing diagnostic precision by more effectively identifying high-risk features. MRI had greater sensitivity than ultrasound in identifying intermediate risk lesions (O-RADS 3 and 4), however ultrasound demonstrated superior specificity in confirming benign (O-RADS 1) and unequivocally malignant (solid) tumours (O-RADS 5).

Key Words: Ovarian cancer, ultrasound, magnetic resonance imaging.

INTRODUCTION

Ovarian cancer is the leading cause of death among gynecological malignancies. The five-year survival rate for those diagnosed with ovarian cancer is 47%. Imaging adnexa can aid in detecting malignant tumors, hence encouraging timely surgical intervention to improve survival chances. This purpose must align with efforts to limit surgical and other invasive interventions for benign lesions. Thus, precise differentiation between malignant and benign adnexal lesions is essential for identifying the most successful treatment strategies.[1]

The treatment options encompass extensive staging surgery for suspected ovarian cancer, minimally invasive laparoscopic surgery for likely benign tumors, and conservative nonsurgical care. Due to the considerable differences across various surgical procedures, it is essential to obtain a conclusive diagnosis. The incidence of women requiring surgery for adnexal masses ranged from 5% to 10%, with less than 25% being malignant. Clinically identified adnexal lesions are confirmed with exploratory surgery and histopathological examination. The classification of the adnexal tumor, whether benign or malignant, remains uncertain prior to surgery.[2]

Ultrasonography serves as the principal diagnostic modality for evaluating a suspected adnexal mass. Magnetic resonance imaging enhances the characterization of adnexal masses which are insufficiently evaluated by ultrasound, providing additional insights into the soft tissue composition of these masses through specific tissue relaxation times and enabling multiplanar imaging to clarify the origin and extent of pelvic pathology.[3]

Ultrasonography (US) is the principal method for imaging evaluation of ovarian and adnexal disorders. However, the experience and proficiency of radiologists in pelvic ultrasonography demonstrate significant variety. As a result, several criteria or grading systems have been proposed to standardize the reporting of ovarian and adnexal abnormalities observed by ultrasonography by radiologists.[4] In 2019, the American College of Radiology (ACR) introduced O-RADS US to enhance risk assessment and treatment of ovarian and adnexal tumors. O-RADS US amalgamates lexicon descriptors of ultrasound features with a risk stratification framework to classify all adnexal masses into an O-RADS category, reflecting the malignancy risk of the masson a scale from 1 to 5 (1, physiologic; 2, almost certainly benign; 3, low malignancy risk; 4,

intermediate malignancy risk; 5, high malignancy risk). While other imaging categories exist, O-RADS is distinct due to its dual modalities of ultrasound and MRI.[5]

The objective of ACR in formulating O-RADS MRI risk classification is to ensure the consistency of assessing adnexal masses using MRI and to improve the quality of imaging reports.

Determining whether the adnexal lesion is malignant or benign is important for giving appropriate treatment to the patient. A precise diagnosis is essential since timely and appropriate treatment can significantly diminish the risk of complications and death, hence improving the patient's overall prognosis. The study seeks to clarify the diagnostic efficacy of O-RADS ultrasound and MRI in the risk assessment and diagnosis of adnexal mass lesions.

AIMS & OBJECTIVES

AIM

Comparison between ultrasound and MRI in the characterization of the adnexal masses by Ovarian Adnexal Reporting and Data System (O-RADS).

OBJECTIVES

To evaluate the ability of USG & MRI to determine which imaging features are predictive of malignancy.

MATERIALS AND METHODS

Duration of the study: 12 months (April 2025 - May 2026).

Sample size: 50

Study design: Prospective study

Source of the data: Female patients presenting with lower abdominal discomfort and menstrual abnormalities are evaluated at the Department of Obstetrics and Gynaecology and thereafter referred to the Department of Radiodiagnosis at GGH, Kurnool for radiological assessment.

Inclusion Criteria

- Patients with clinically suspected cases of adnexal mass lesions.
- Adnexal mass lesions were found incidentally on USG

Exclusion Criteria

- Clinically and sonographically confirmed instances of ectopic pregnancy.
- Patients who have had a hysterectomy.

- Individuals with adenomyosis, wide ligament fibroids, and those with severe pelvic discomfort.
- All patients with cardiac pacemakers, artificial heart valves, cochlear implants, or other metallic implants.
- Patients exhibiting claustrophobia

PROCEDURE

Following the approval of the institutional Ethics committee, all patients included in the study will be informed about the procedure, and informed permission will be secured. A thorough history assessment and screening for clips, metallic implants, and other pertinent criteria will be performed for all patients.

All patients will have transabdominal and transvaginal sonography with the ESOATE MyLab system. Adnexal lesions will be evaluated in the ultrasonogram for several attributes, including dimensions, composition, vascularity, papillary projections, septations, and the presence of ascites.

Thereafter, these patients will have an MRI to evaluate lesion dimensions, composition, enhancement, ascites, omental deposits, and lymphadenopathy. The patients will have an MRI at 1.5 Tesla. The patients will be evaluated in a supine position, and the subsequent sequences will be performed: T1 axial, T2 sagittal, coronal, axial, T1 fat-saturated, T1 axial in and out of phase, T1 non-dynamic contrast axial and coronal. axial diffusion-weighted imaging.

STATISTICAL ANALYSIS

Data will be entered into the Excel spreadsheet. Descriptive statistics will be performed to ascertain the mean, standard deviation, and percentages. Inferential statistics, including chi-square and unpaired t-test, will be utilized for qualitative and quantitative data, respectively, employing SPSS (Statistical Package for the Social Sciences) version 20. Further necessary tests will be performed during the analysis, depending on data distribution.

Investigations Required

serum creatinine, Trans Abdominal Scan with Curvilinear probe with ESOATEmylab6. MRI Imaging with 1.5 tesla superconducting magnet Philips machine.

Statistical Analysis: Data was inputted in MS Excel (2010) and subsequently imported into IBM SPSS Version 26.0 for analysis. Data is conveyed using tables and figures. Categorical variables are characterized by frequencies and percentages, whereas continuous data are summed using the mean and standard deviation. The Fisher Exact test was employed for categorical results, while the Mann-Whitney U test was utilized for the comparison of continuous outcomes. Spearman Correlation analysis was conducted to examine the relationship between USG O-RADS and MRI O-RADS.

RESULTS

A total of 50 female patients were enrolled in the study. The mean age of participants in our study was 31.24 ± 10.45 years with a range of 19 to 60 years. The majority of patients (n=36,72.0%) were premenopausal and14 (28%) were post-menopausal.

Adnexal lesions Identified on USG

On USG, Physiological cyst was found in 16 (32%) patients, unilocular cysts in 7(14%), Multi locular cyst in 13(32%), hemorrhagic cyst in 5(10%), Solid lesion in 3(6%), dermoid in2(4%), endometrium in 1(2%), para-ovarian cyst in1(2%), peritoneal inclusion cyst in 1(2%), hydrosalpinx in 1(2%) patients each (Table 4,Chart 2).

Table 1: Adnexal lesions Identified on USG

Lesion	Frequency	Percentage
Physiological Cyst	16	32%
Haemorrhagic Cyst	5	10%
Peritoneal Inclusion Cyst	1	2%
Hydrosalpinx	1	2%
Paraovarian cyst	1	2%
Dermoid	2	2%
Endometrioma	1	2%
Unilocular cyst	7	14%
Multilocular Cyst		

Table 2: Adnexal lesions Identified on MRI

Lesion	Frequency	Percentage
Physiological Cyst	16	32%
Haemorrhagic Cyst	5	10%
Peritoneal Inclusion Cyst	1	2%
Hydrosalpinx	1	2%
Paraovarian cyst	1	2%
Dermoid	2	4%
Endometrioma	1	2%

Unilocular cyst	6	12%
Multilocular Cyst	14	28%
1.With solid Components	8	16%
2.Without solid Components	6	12%
Solid lesion	3	6%

On MRI, Physiological cyst was found in 16 (32%) patients, unilocular cysts in 6(12%), Multilocular cysts in 14(28%), hemorrhagic cysts in 5(10%), Solid lesion in 3(6%), dermoid in 2(4%), endometrioma in 1(2%), Para ovarian cyst in 1(2%), peritoneal Inclusion cyst in 1(2%), hydrosalpinx in 1(2%) patients each.

Table 3: Comparison of Adnexal Lesions Identified on USG and MRI

Adnexal Lesion	On USG	On MRI
Physiological Cyst	16	16
Haemorrhagic Cyst	5	5
Peritoneal Inclusion Cyst	1	1
Hydrosalpinx	1	1
Paraovarian cyst	1	1
Dermoid	2	2
Endometrioma	1	1
Unilocular cyst	7	6
Multilocular Cyst		
1.With solid components	6	8
2.With out solid components	7	6
Solid lesion	3	3

O-RADS Assigned on USG and MRI

On USG examination and categorization of patients based on O-RADS, 16(32%) were O-RADS 1, 14(28%) O-RADS 2, 10 (20%) O-RADS3, 5(10%) O-RADS 4 and 5(10%) Were O-RADS5. While on MRI, 16(32%) were categorized as O-RADS1, 14(28%) as O-RADS2,8(16%) as O-RADS3,6(12%) O-RADS4 and 6(12%) as O-RADS5.

Table 4: O-RADS Assigned on USG and MRI

O-RADS category	No. of Patients on USG	No. of Patients on MRI
1	16(32%)	16(32%)
2	14(26%)	14(28%)
3	10(20%)	8(16%)
4	5(10%)	6(12%)
5	5(10%)	6(12%)

Table 4 presents the distribution of patients across different O-RADS (Ovarian-Adnexal Reporting and Data System) categories based on USG (Ultrasound) and MRI (Magnetic Resonance Imaging) examinations. The table categorizes patients into five O-RADS categories, ranging from O-RADS 1 to O-RADS 5.

- O-RADS 1: Both USG and MRI identified 16 patients (32%) in the O-RADS 1 category.
- O-RADS 2: Both USG and MRI identified 14 patients (28%) each in the O-RADS 2 category.
- O-RADS 3: On USG, 10 patients (20%) were categorized as O-RADS 3. On MRI8 patients (16%) were categorized as O-RADS 3.
- O-RADS 4: On USG, 5 patients (10%) were classified as O-RADS 4, whereas MRI identified 6 patients (12%) in this category.
- O-RADS 5: On USG, 5 patients (10%) were classified as O-RADS 4, whereas MRI identified 6 patients (12%) in this category
- The table highlights the consistency and discrepancies between USG and MRI in categorizing adnexal lesions, providing valuable insights into the diagnostic accuracy and reliability of these imaging modalities.

One patient in O-RADS 2 on USG was upgraded to O-RADS 3 on MRI, one patient in O-RADS 3 on USG was downgraded to O-RADS 2 on MRI, two in O-RADS 3 on USG were upgraded to O-RADS 4 on MRI, one in O-RADS 4 on USG was upgraded to O-RADS 5 on MRI.

Table 5: Comparison of O-RADS on USG and MRI

O-RADS on USG	O-RADS on MRI	No. of Patients
1	1	16
2	2	13
	3	1
3	2	1
	3	7
	4	2
4	4	4
	5	1
5	5	5

Reasons for Change in Category on MRI

- Presence of Solid component in Multilocular cyst.
- Enhancement pattern in non-dynamic contrast-enhanced MRI.
- Number of loculations.

Thus, in comparison to MRI, USG gives a sensitivity of 100% and specificity of 100% for O-RADS 1, PPV is 100% and NPV is 100%. For O-RADS2, the sensitivity is 92.86%, Specificity is 97.22%, PPV is 92.86% and NPV is 97.22%. For O-RADS 3, the sensitivity was found to be 87.5%, specificity 92.86%, PPV70% and NPV 97.5%. For O-RADS 4 lesion USG yielded a sensitivity of 66.67%, specificity of 97.73%, PPV of 80%, and NPV of 95.56%. For O-RADS5, it yields a sensitivity of 83.33%, specificity of 100%, PPV of 100%, and NPV of 97.78%.

Correlation between USGO-RADS and MRIO-RADS

Spearman correlation was studied between USG O-RADS score and MRI O-RADS score. A strong positive correlation was observed (ρ=0.9, P<0.001).

Comparison of USG and MRI O-RADS Category of Pre and Post-Menopausal Women

As shown in the Table, post-menopausal women tended to fall in higher USGO-RADS class (IV and V) compared to Premenopausal women where common lesions belonged to Class I and II. This difference was statistically significant (P<0.001).

Table 6: Comparison of USG O-RADS Category of Pre and Post-Menopausal Women

Variable	USG O-RADS Category					Significance
	I	II	III	IV	V	
Premenopausal	16 (44.4%)	14 (38.8%)	6(16.7%)	0 (0.0%)	0 (0.0%)	P<0.001
Postmenopausal	0 (0.0%)	0 (0.0%)	4 (28.6%)	5 (35.7%)	5 (35.7%)	

*Fisher Exact Test

A similar trend was observed in MRI O-RADS categorization (Table 7). The difference was statistically significant (P<0.001)

Table 7: Comparison of MRI O-RADS Category of Pre and Post-Menopausal Women

Variable	MRIO-RADS Category					Significance*
	I	II	III	IV	V	
Premenopausal	16 (32.6%)	14 (27.9%)	6 (23.3%)	0	0	P<0.001
Postmenopausal	0	0	2	6 (23.3%)	6 (23.3 %)	

*Fisher Exact Test

The mean O-RADS score assigned on USG for premenopausal women was 2.11±1.13 which was significantly lower than the score of 3.59 ± 1.25 for postmenopausal women (P=.001)

The mean O-RADS score assigned on MRI for premenopausal women was 2.21±1.09 which was significantly lower than 3.58 ± 1.59 for postmenopausal women (P=0.004).

Table 8: Comparison of USG and MRI O-RADS scores of Pre and Post-menopausal Women

Variable	Premenopausal	Postmenopausal	Significance
USGO-RADS	2.11± 1.13	3.59 ±1.25	P=0.001
MRIO-RADS	2.21±1.09	3.58 ±1.59	P=0.004

#Mann Whitney U test

DISCUSSION

The uterine adnexa display a significant range of variations, including benign cysts and possibly malignant tumours. The quick and precise diagnosis and understanding of these masses are crucial for delivering effective therapeutic treatment and attaining favourable patient outcomes. Ultrasonography (USG) and MRI are often employed imaging techniques for the evaluation of adnexal mass lesions, allowing examination without the need for invasive procedures.[6]

Ultrasound (USG) is a widely used imaging technique, noted for its broad availability, cost-effectiveness, and ability to provide real-time images. The MRI approach provides enhanced soft tissue contrast and the capacity to get pictures from various angles, therefore delivering essential insights for the examination of complex adnexal mass lesions. This research aims to analyze the correlation between ultrasonographic results and MRI evaluations to enable an early and conclusive identification of adnexal masses.[7]

This study conducts a comparative comparison of the functions of Ultrasonography and MRI in the assessment of adnexal masses. A correlation and comparison of sensitivity, specificity, and accuracy between ultrasonography (USG) and magnetic resonance imaging (MRI) were performed. This research's findings significantly enhance the accuracy of diagnoses for adnexal masses, potentially improving patient outcomes. This study seeks to provide a comprehensive evaluation of the efficacy of ultrasonography (USG) and magnetic resonance imaging (MRI) compared to the recognized gold standard of histopathological examination (HPE). This study aims to provide substantial insights into the strengths and shortcomings of each imaging modality.[8]

The accurate and prompt detection of adnexal masses is crucial for differentiating between benign and malignant tumors. This distinction offers critical insights that might improve appropriate therapeutic care and perhaps reduce the need for invasive procedures. This research aims to augment existing knowledge by providing current data and unique perspectives that might influence clinical practice recommendations and decision-making in gynecological oncology.

The research included a total of 50 female participants. The mean age of the research participants was determined to be 31.24 years, with a standard deviation of 10.45 years, and ages ranged from a minimum of 19 years to a maximum of 60 years. A substantial number of the patients, namely 36 individuals, constituting 72.0%, were categorized as premenopausal, whereas a lesser group of 14 individuals, representing 28%, were recognized as postmenopausal.[9]

In a similar study by Roshed et al. in 2018, it was noted that a substantial percentage, precisely 36.90%, of participants fell between the age range of 21 to 30 years. The subsequent cohort, aged 31 to 40 years, comprised 20.24% of the sample.

The current study's ultrasound findings indicated physiological cysts in 16 patients, constituting 32% of the sample; hemorrhagic cysts in 5 patients, representing 10%; and peritoneal inclusion cysts, hydrosalpinx, para ovarian cysts, and endometriomas, each identified in 1 patient, each accounting for 2% of the sample. Dermoid cysts were detected in 2 patients, accounting for 4%; unilocular cysts were found in 7 patients, representing 14%; and multilocular cysts were noted in 13 patients, equating to 26%. Three individuals exhibited solid lesions, constituting 6% of the overall group.[10]

CONCLUSION

The study demonstrates a strong correlation between ultrasound (USG) and magnetic resonance imaging (MRI) in categorizing adnexal lesions using the Ovarian-Adnexal Reporting and Data System (O-RADS), with MRI enhancing diagnostic precision by more effectively identifying high-risk features. MRI had greater sensitivity than ultrasound in identifying intermediate risk lesions (O-RADS 3 and 4), however ultrasound demonstrated superior specificity in confirming benign (O-RADS 1) and unequivocally malignant (solid) tumours (O-RADS 5). This study results are in accordance with previous studies, which showed that MRI has high accuracy in characterization of adnexal mass lesions. Postmenopausal women exhibited more complex lesions, underscoring the need for tailored imaging protocols. While ultrasonic guiding (USG) is advantageous for initial evaluation, MRI offers further advantages in ambiguous or high-risk situations, particularly for multilocular or solid lesions. These results support the integrated use of both modalities in clinical practice to improve diagnosis accuracy. Ultrasound is the primary imaging technique for evaluating adnexal mass lesions. Nonetheless, MRI assessment is very accurate for identifying the tumor's origin, tissue features and composition, staging, and preoperative planning. MRI demonstrates superior accuracy compared to ultrasound imaging.

MRI outperforms ultrasonography in diagnosing and characterizing adnexal mass lesions. The exceptional accuracy of MRI facilitates its application in the preoperative planning of a sonographically indeterminate tumour. Furthermore, age above 50 years, post-menopausal condition, solid and difficult tumour morphology, and tumour bilaterality significantly increase the likelihood of malignancy; therefore, these parameters may be employed to assess the risk of malignancy in ovarian tumours. Acquaintance with the diagnostic efficacy of O-RADS US and O-RADS MRI will be beneficial as these modalities are increasingly incorporated into clinical practice.

REFERENCES

1. Lheureux S, Braunstein M, Oza AM. Epithelial ovarian cancer: Evolution of management in the era of precision medicine. CA Cancer J Clin. 2019 Jul;69(4):280–304.
2. Narod S. Can advanced-stage ovarian cancer be cured? Nat Rev Clin Oncol. 2016 Apr;13(4):255–61.
3. Adusumilli S, Hussain HK, Caoili EM, Weadock WJ, Murray JP, Johnson TD, et al. MRI of Sonographically Indeterminate Adnexal Masses. American Journal of Roentgenology. 2006 Sep;187(3):732–40.
4. Sohaib SAA, Sahdev A, Trappen PV, Jacobs IJ, Reznek RH. Characterization of Adnexal Mass Lesions on MR Imaging. American Journal of Roentgenology. 2003 May;180(5):1297–304.
5. Agostinho L, Cruz R, Osório F, Alves J, Setúbal A, Guerra A. MRI for adenomyosis: a pictorial review. Insights Imaging. 2017 Dec 1;8(6):549–56.

6. Saini A, Dina R, McIndoe GA, Soutter WP, Gishen P, deSouza NM. Characterization of Adnexal Masses with MRI. American Journal of Roentgenology. 2005 Mar;184(3):1004–9.
7. Amor F, Alcázar JL, Vaccaro H, León M, Iturra A. GI-RADS reporting system for ultrasound evaluation of adnexal masses in clinical practice: a prospective multicenter study. Ultrasound Obstet Gynecol. 2011 Oct;38(4):450–5.
8. Andreotti RF, Timmerman D, Strachowski LM. O-RADS US Risk Stratification and Management System: A Consensus Guideline from the ACR Ovarian- Adnexal Reporting and Data System Committee. Radiology. 2020;294(168).
9. Wang T, Cui W, Nie F, Huang X, Huang L, Liu L, et al. Comparative Study of the Efficacy of the Ovarian-Adnexa Reporting and Data System Ultrasound Combined With Contrast-Enhanced Ultrasound and the ADNEX MR Scoring System in the Diagnosis of Adnexal Masses. Ultrasound Med Biol. 2023.Sep;49(9):2072–80.
10. Lai HW, Lyu GR, Kang Z, Li LY, Zhang Y, Huang YJ. Comparison of O-RADS, GI-RADS, and ADNEX for Diagnosis of Adnexal Masses: An External Validation Study Conducted by Junior Sonologists. J Ultrasound Med. 2022 Jun;41(6):1497–507.