ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 6, Issue – 4, July - 2023, Page No. : 166 - 172

Correlation study of o-rads scoring system in USG and MRI of ovarian masses with histopathology

[1]Dr. Pooja Nimbalkar, Resident, M. S. Ramaiah Medical College and Hospital, Bengaluru - 560054

[2]Dr. Akash Rajaram, Associate Professor. S. Ramaiah Medical College and Hospital, Bengaluru - 560054

[3]Dr. Umesh Krishnamurthy, Head of the department. S. Ramaiah Medical College and Hospital, Bengaluru - 560054

[4]Dr. Aravind, Resident, M. S. Ramaiah Medical College and Hospital, Bengaluru - 560054

Corresponding Author: Dr. Pooja Nimbalkar, Resident, M. S. Ramaiah Medical College and Hospital, Bengaluru - 560054

How to citation this article: Dr. Pooja Nimbalkar, Dr. Akash Rajaram, Dr. Umesh Krishnamurthy, Dr. Aravind, Resident, "Correlation study of o-rads scoring system in USG and MRI of ovarian masses with histopathology", IJMACR- July - 2023, Volume – 6, Issue - 4, P. No. 166 – 172.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Ovarian masses are commonly encountered gynecological conditions in both premenopausal and postmenopausal female patients. Imaging plays an important role in characterizing these masses into benign and malignant, thus providing necessary information to the gynecologists for further management. US O-RADS and MRI O-RADS provide standard lexicon to eliminate the confusions and increase the accuracy in risk stratification.

Methodology: This study is a prospective study carried out on 33 patients of all age groups who were detected to have ovarian mass on USG or MRI. Data will be collected from all the patients diagnosed as having ovarian mass on USG or pelvic MRI who meet the inclusion criteria. Ovarian masses are scored based on The Ovarian-Adnexal Reporting and Data System (O-RADS) US risk stratification and management system or Ovarian-Adnexal Reporting and Data System in Magnetic Resonance Imaging (O-RADS MRI). Patients were evaluated for presence of ovarian masses and differentiation between benign and malignant masses, using histopathological examination as standard of reference.

Results: Out of 33 patients, 13 patients underwent both MRI and USG, and rest of the patients underwent either USG or MRI. All of the patients who were scored based on USG O-RADS underwent surgery, of them 21 cases (63.6 %) were benign with score of 3 or less, 2 cases (6.1 %) were borderline with score of 4 and 10 cases (30.2 %) were malignant with score of 4 or 5. CA-125 showed statistical significance in predicting malignancy. All of the patients who were scored based on MRI O-RADS also underwent surgery, of them 26 cases (78.8

%) were benign with score of 3 or less and 7 cases (21.2 %) were malignant with score of 4 or 5. ORADS US and MRI score was able to differentiate benign from malignant cases in 90.9% patients and 93.9% respectively. They proved to be statistically significant with p value of < 0.001.

Conclusion: In this study, the O-RADS US and MRI score was found to be sensitive and specific in stratification of the risk of malignancy in adnexal masses. For characterization of ovarian lesions, ultrasound is often the first line method of choice and most of the lesions can be grouped as benign or malignant. O-RADS MRI scoring system is useful for the masses which are indeterminate on ultrasound. The accurate characterization of the ovarian lesions is essential for optimal management.

Keywords: O-RADS US and MRI score, benign and malignant, adnexal masses, characterization, histopathology

Introduction

Ovarian masses are common forms of gynecological problems that can range from physiological cysts to highly aggressive neoplastic lesions and are common in women of all age groups, ovarian cancer being the fifth leading cause of cancer death in females.[1]

Imaging with ultrasound is often the first-line method of choice in assessment of any abdomino - pelvic mass detected clinically specially to distinguish cystic from solid lesions. For complex lesions, primary evaluation with ultrasound is often followed by further assessment on higher imaging modality like MRI.

The accurate characterization of ovarian masses is necessary for better patient management.[2] Masses felt to be benign can be managed expectantly or with minimal-access surgery whereas malignant pathology will require gynaecological oncologist opinion.

The Ovarian-Adnexal Reporting and Data System (O-RADS) US risk stratification and management system recommends six categories (O-RADS scores 0 through 5) to distinguish the risk of malignancy with their management. [2]

On ultrasound most of the masses can be accurately grouped as benign or malignant, however few of them remain indeterminate. Ovarian-Adnexal Reporting and Data System in Magnetic Resonance Imaging (O-RADS MRI) is a scoring system for preoperative characterization of these indeterminate ovarian masses.[3] This could reduce the patients from undergoing unnecessary surgery.

Therefore, the main objective of this study is to check the validity of Ultrasound (Transabdominal and/ or transvaginal) or Magnetic Resonance Imaging score for risk stratification and preoperative characterization in women with ovarian masses in comparison with histopathology as the reference standard.

Aims And Objectives

1. To score and characterize the ovarian masses by O-RADS scoring system (USG and MRI).
2. To differentiate benign and malignant masses based on O-RADS score in comparison with histopathological examination.

Materials And Methods

This is a prospective study carried out on 33 patients diagnosed to having ovarian masses on USG and MRI in MS Ramaiah hospitals, Bangalore over a period of 18 months. The sample size was calculated based on Thomassin- Naggara et al [3] in Ovarian-Adnexal Reporting Data System Magnetic Resonance Imaging

(O-RADS MRI) Score for Risk Stratification of Sonographically Indeterminate Adnexal Masses.

Thomassin- Naggara et al [3] [2020] study has observed that the sensitivity and specificity of discriminating between benign and malignant lesions based on O-RADS (MRI) scoring was 93% and 91% respectively. In the present study expecting similar result with 95% confidence interval and 3.3% precision, study requires a minimum of 33 subjects.

Descriptive statistics of O- RADS score will be analyzed and summarized in terms of mean with standard deviation. Qualitative variables such as benign and malignant will be summarized in terms of percentage. ROC curve would be used to find the cut - off point in detection of malignancy based on O- RADS score.

Sensitivity, specificity, negative predictive value, positive predictive value will be used to validate the O-RADS score in detecting benign and malignant ovarian masse.

Purpose of the study will be explained to the patient and informed consent will be taken. Detailed history of patient will be entered in the Performa. Data will be collected from all the patients diagnosed as having ovarian mass on USG or pelvic MRI who meet the inclusion criteria. Ovarian masses are scored based on The Ovarian-Adnexal Reporting and Data System (O-RADS) US risk stratification and management system [2] or Ovarian-Adnexal Reporting and Data System in Magnetic Resonance Imaging (O-RADS MRI) [3] Patients were evaluated for presence of ovarian masses and differentiation between benign and malignant masses, using histopathological examination as standard of reference.

Results

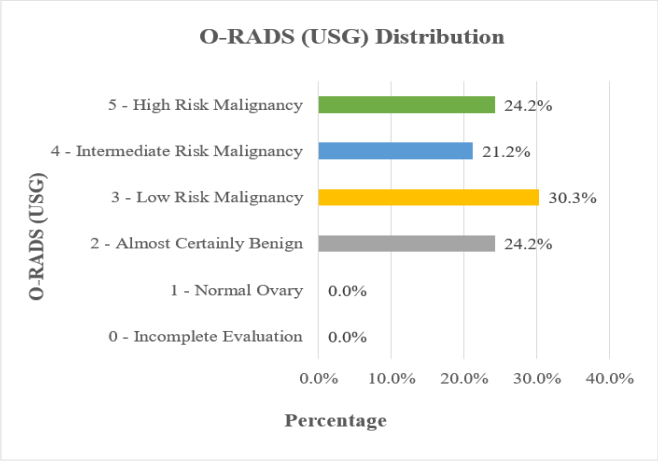
In the study, majority of the subjects who underwent USG and MRI belonged to the age group of 31 to 45 years (33.3%). The mean age of the subjects was 43.79 ± 14.67 years. Most of patients were affected unilaterally (78.8% on USG and 75.8% on MRI), and the remaining were affected bilaterally (21.2% on USG and 24.2% on MRI).

Table 1: Parameters of the ovarian mass observed by USG

		Frequency (N)	Percentage (%)
Septations	Present	20	60.6%
	Absent	13	39.4%
Calcifications	Present	3	9.1%
	Absent	30	90.9%
Ascites	Present	6	18.2%
	Absent	27	81.8%
Peritoneal Nodules / Thickening	Present	5	15.2%
	Absent	28	84.8%

On observing the ovarian mass by USG in the study, septations, calcifications, ascites and peritoneal nodules were present in 60.6%, 9.1%, 18.2% and 15.2% respectively.

Figure 1: Bar diagram showing Distribution of the study subjects based on O-RADS (USG)



Based on USG O-RADS, majority of the subjects were diagnosed with low-risk malignancy (30.3%). About

24.2% of the subjects were observed to be at high risk of malignancy.

Table 2: Parameters of the ovarian mass observed by MRI.

		Frequency (N)	Percentage (%)
Septations	Present	18	54.5%
	Absent	15	45.5%
Lipid Content	Present	3	9.1%
	Absent	30	90.9%
Wall Enhancement	Present	22	66.7%
	Absent	11	33.3%
Enhancing Solid Tissue	Present	9	27.3%
	Absent	24	72.7%
Ascites	Present	3	9.1%
	Absent	30	90.9%
Nodularity/Thickening	Present	3	9.1%
	Absent	30	90.9%

Figure 2: Bar diagram showing Distribution of the study subjects based on O-RADS (MRI)

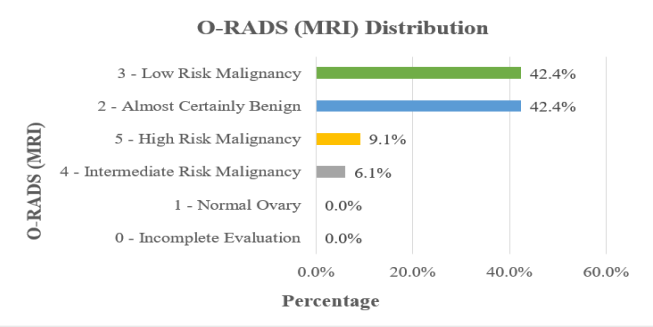


Table 3: MRI O-RADS in prediction of malignancy (based on HPE)

Area under the ROC curve (AUC)

Area under the ROC curve (AUC)	0.934
Standard Error[a]	0.0449
95% Confidence interval[b]	0.790 to 0.991
z statistic	9.672
Significance level P (Area=0.5)	<0.0001

Youden index

Youden index J	0.7143
Associated criterion	>3

In the study, the prediction of malignancy was analysed by observing the MRI O-RADS. Accordingly, the criterion level was observed to be >3, where the sensitivity and specificity of the investigation was found to be 71.4% and 100.0% respectively. This has proven to be statistically significant thereby suggesting that the MRI O-RADS is good predictor of malignancy.

Figure 3. Bilateral serous cystadenocarcinoma with peritoneal metastasis.

TAS showing bilateral adnexal solid cystic mass without significant vascularity on the left (A) and moderate color flow on the right (B).

USG O-RADS score - 5

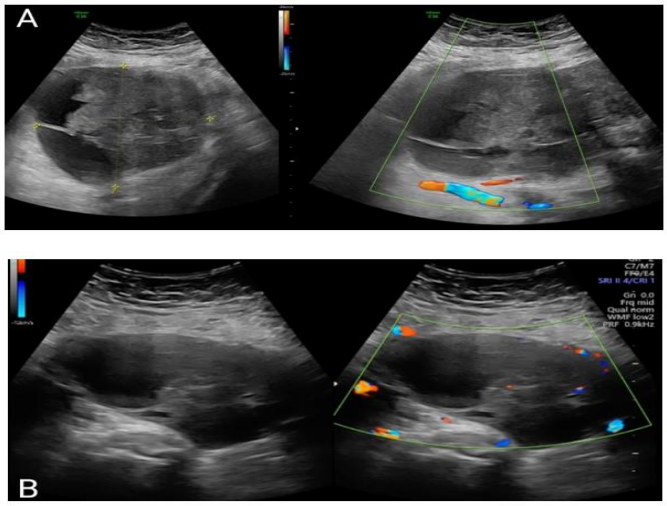


Figure 4. Malignant degeneration in left ovarian mature teratoma

TAS showing cystic left ovarian mass with solid component and calcification (A). Axial T1WI (B) and axial T2WI (C) showing fat fluid level (green arrow) and non-enhancing nodule with calcifications (red arrow). T1 post contrast fat saturated image (D) showing wall enhancement. The DWI (E) and ADC (F) imagesshow peripheral diffusion restriction in the non-enhancing nodule.

USG O-RADS score - 3 MRI O-RADS score - 2

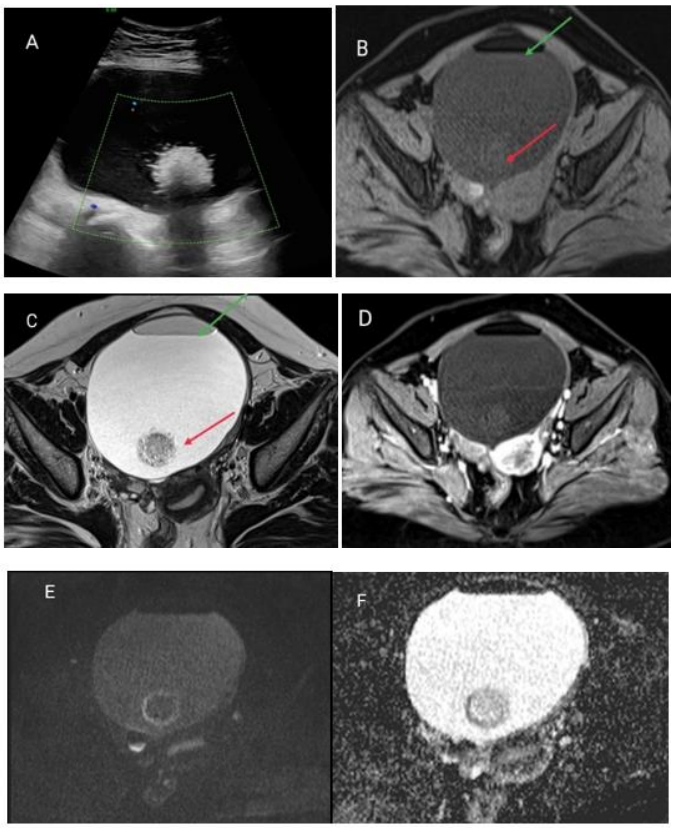
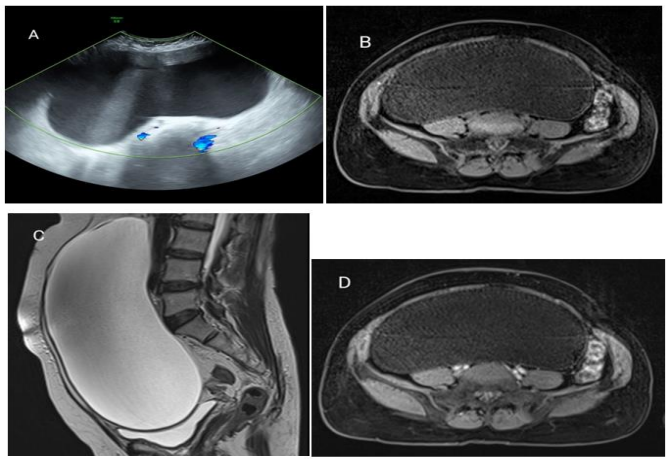


Figure 5. Right ovarian serous cystadenoma

TAS showing large unilocular abdomino-pelvic cystic mass without vascularity (A). Axial T1WI (B) and sagittal T2WI (B) show the extent of the right ovarian cystic mass upto the epigastric region. No evidence of enhancing septations or mural nodules on T1 post contrast fat saturated image (D).

USG O-RADS score - 2 MRI O-RADS score - 2



Discussion

The Ovarian-Adnexal Reporting and Data System (O-RADS) US risk stratification and management system was developed by a committee sponsored by American College of Radiology based on lexicon published in 2018 [2]. This system was designed to stratify and assess the risk of adnexal and ovarian masses with more conservative management in case of benign appearing masses and referral to gynecological oncology if the mass is suspicious for malignancy [4].

The overall frequency of malignant neoplasm in our study in the O-RADS US 2 category was 0 of 8 lesions, O-RADS US 3 category was 0 of 10 lesions, O-RADS US 4 category was 4 of 7 lesions and O-RADS US 5 category was 8 of 8 lesions. In a study conducted by Priyanka Jha et al [4], the overall frequency of malignant neoplasm in the O-RADS US 2 category was 3 of 657 lesions, O-RADS US 3 category was 5 of 112 lesions, O-RADS US 4 category was 18 of 155 lesions and O-RADS US 5 category was 59 of 90 lesions. The specificity of the O-RADS score in detecting malignancy was found to be higher in our study and this might be attributed to the relatively low sample size.

The O-RADS US criterion level was observed to be > 4 for malignant neoplasm determined using Youden index with the area under the ROC curve of 0.97, where the sensitivity and specificity of the investigation was found to be 80.0% and 100.0% respectively. A study by Hui Luo et al [5] the area under the receiver operating characteristic curve for the model in predicting ovarian malignancy was 0.962 and the sensitivity and specificity were 86.8% and 98.1% respectively.

The O-RADS system had the highest AUC and Youden index according to study conducted by Yuyang Guo et al [6] where comparison of the diagnostic performance of

the O-RADS, RMI4, IOTA LR2, and IOTA SR systems was made.

In the study, the prediction of malignancy was also analyzed by observing the MRI O-RADS. Accordingly, the criterion level was observed to be > 3 with the area under the ROC curve of 0.93, where the sensitivity and specificity of the investigation was found to be 71.4% and 100.0% respectively. A study by Aniruddha Basu [7] considered cut-off of ≥4 for malignant disease showed 92.3% sensitivity and 87.8% specificity for identifying malignant adnexal lesions.

Our study showed a 0%, 0%, 14.2%, 100%, and 100% malignancy rate for O-RADS MRI scores of 1, 2, 3, 4, and 5, respectively. Our results are similar to those reported by Thomassin-Naggara et al [3] except for the cases with an O-RADS MRI score of 1 and 4 and is that is likely due to more number of cases included in the study by Thomassin-Naggara et al [3].

A moderate or marked increase in the signal intensity of an ovarian mass in relation to that of the myometrium after gadolinium injection is associated with borderline and malignant tumors. The enhancement of the solid tissue is classified using time intensity curve (TIC) classification [8]. In our study, among the subjects applicable for time intensity curve, majority of the masses with low risk (11.5%) TIC curve were observed to be benign cases, while those with high risk (42.9%) TIC curve were observed to be malignant cases. Thus, the study found statistically significant association between HPE diagnosis and time intensity curve. Similarly, a study conducted by Li HM [9] showed that 83% of malignant masses showed type III TIC and 81% of benign masses showed type I TIC.

Conclusion

This study was a hospital-based prospective study carried out on 33 patients with ovarian masses to correlate the USG and MRI O-RADS score with histopathology. It portrays standard terminologies and imaging findings for characterizing the benign and malignant lesions.

Abbreviations

ADC	Apparent diffusion coefficient
DWI	Diffusion weighted imaging
MRI O-RADS	Magnetic Resonance Imaging Ovarian-Adnexal Reporting and Data System
US O-RADS	Ultrasound Ovarian-Adnexal Reporting and Data System
T1WI and T2WI	T1 and T2 weighted imaging
TAS	Transabdominal scan
TIC	Time Intensity Curve

References

1. Taylor E C., L. Irshaid and M. Mathur, 'Multimodality Imaging Approach to Ovarian Neoplasms with Pathologic Correlation', radiographics, 41/1 (2021), < https://doi.org/10.1148/rg.2021200086 > accessed 15 July 2023, 289-315.
2. Andreotti R F. Et al, 'O-rads Us Risk Stratification and Management System: A Consensus Guideline from the Acr Ovarian-adnexal Reporting and Data System Committee', Radiology, 294/1 (2020), < https://doi.org/10.1148/radiol.2019191150 > accessed 15 July 2023, 168-185.
3. Thomassin-naggara I. Et al, 'Ovarian-adnexal Reporting Data System Magnetic Resonance Imaging (o-rads Mri) Score for Risk Stratification of Sonographically Indeterminate Adnexal Masses', JAMA Network Open, 3/1 (2020), <

https://doi.org/10.1001/jamanetworkopen.2019.19896 > accessed 15 July 2023, e1919896.

4. Jha P. Et al, 'Diagnostic Performance of the Ovarian-adnexal Reporting and Data System (o-rads) Ultrasound Risk Score in Women in the United States', JAMA Network Open, 5/6 (2022), < https://doi.org/10.1001/jamanetworkopen.2022.16370 > accessed 15 July 2023, e2216370.
5. Luo H. Et al, 'Application of O-rads Ultrasound Lexicon-based Logistic Regression Analysis Model in the Diagnosis of Solid Component-containing Ovarian Malignancies', biomed Research International, 2022 (2022), < https://doi.org/10.1155/2022/7187334 > accessed 15 July 2023, 1-9.
6. Guo Y. Et al, 'A Comparison of the Diagnostic Performance of the O-rads, Rmi4, Iota Lr2, and Iota Sr Systems by Senior and Junior Doctors', Ultrasonography, 41/3 (2022), < https://doi.org/10.14366/usg.21237 > accessed 15 July 2023, 511-518.
7. Aslan S. And S. A. Tosun, 'Diagnostic Accuracy and Validity of the O-rads Mri Score Based on a Simplified Mri Protocol: A Single Tertiary Center Retrospective Study', Acta Radiologica, 64/1 (2023), < https://doi.org/10.1177/02841851211060413 > accessed 15 July 2023, 377-386.
8. Pereira P N. Et al, 'Assessment of the Performance of the O-rads Mri Score for the Evaluation of Adnexal Masses, with Technical Notes', *Radiologia Brasileira*, 55/3 (2022), < https://doi.org/10.1590/0100-3984.2021.0050 > accessed 15 July 2023, 137-144.
9. Li H. Et al, 'The Value of Dynamic Contrast enhanced Mri in Characterizing Complex Ovarian Tumors', *Journal of Ovarian Research*, 10/1 (2017), < https://doi.org/10.1186/s13048-017-0302-y > accessed 15 July 2023.