ORIGINAL ARTICLE

Risk Stratification of Adnexal Masses Using MRI Ovarian-Adnexal Reporting and Data System (O-RADS) In Comparison to Sonographic Evaluation

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ABSTRACT

Objective: To assess the improvement in MRI categorization of adnexal lesions in females by adoption of standardized ovarian and adnexal reporting and data system (O-RADS) for differentiation between benign and malignant masses, in comparison to sonographic findings.

Study Design: Descriptive cross-sectional study.

Place and Duration of Study: Radiology department of CMH Abbottabad for a period of 12 months from 01 September 2021 to 31 August 2022.

Materials and Methods: A total of 26 adult female patients with pelvic masses referred to CMH Abbottabad between September 2021 to August 2022 for MRI pelvis were included in the study with the prerequisite of prior ultrasound examination. Signal characteristics of adnexal masses, presence of septae, papillary projections, degree of enhancement, diffusion restriction, and ancillary findings were identified. Grading of the lesions was performed according to O-RADS following the American College of Radiologists (ACR) criteria- from 1-5 in order of potential of malignancy; findings were compared with sonographic results. Clinico-lab correlation and management outcomes of these patients were followed for final diagnosis.

Results: Out of 26 patients included in the study, majority were benign on MRI - 84.6% (n=22/26), falling in O-RADS 2/3 categories. Only 2 out of 11 complex cysts (18.2%) turned out to be definitely malignant (O-RADS 5) on MRI, while rest were benign (O-RADS 3) showing varying stages of bleed (9 out of 11 at 81.8%). All sonographically malignant lesions -15.3% of adnexal masses (n=4/26) were confirmed on MRI (O-RADS 5) and histopathology.

Conclusion: Risk stratification scoring through MRI O-RADS aids in accurate differentiation of malignant from benign lesions, particularly in sonographically indeterminate lesions, aiding gynaecologists in timely management and referral of these patients.

Key Words: *Adnexal, Malignancy, MRI, Risk, Stratification.*

Introduction

Pelvic adnexal masses are a common gynaecological finding. However, they are also a diagnostic and management dilemma. Usually, adnexal masses present incidentally or during a physical examination.[1] However females may present with gynaecological symptoms like irregular or post-menopausal per vaginal bleeding, palpable masses or feeling of lower abdominal heaviness/ pain. At times, these masses may present in asymptomatic women, discovered incidentally on ultrasound done for other reasons. Initial categorisation of these is done by ultrasound which may prove diagnostic; in borderline findings however, decision has to be made on magnetic resonance imaging (MRI).

Pelvic adnexal masses form a large proportion of referrals to Radiology department in women of all ages. Ultrasound is a safe, hazard-free, and sufficiently reliable first investigation for gynaecological assessment of pelvic lesions.[2] In cases however, which lack definitive sonographic benign and malignant features, further investigation becomes mandatory for optimal management. American College of Radiologists (ACR) approved Ovarian and Adnexal Reporting and Data System (O-RADS) was devised for MRI assessment of adnexal masses for risk stratification.[2] MRI with its unique ability to identify the nature of lesion contents - in particular haemorrhage- enhancement pattern, and ancillary findings can provide characterization of

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these lesions with considerable accuracy. A sensitivity of 85% has been reported for detecting malignant masses on MRI, even without the use of O-RADS.[3] It is imperative to draw a line between benign and malignant etiology in adnexal masses for appropriate management; however, ultrasound and even serological tumor markers at times are inadequate to characterize these lesions reliably.[1] To avoid misdiagnosis MRI O-RADS provides a considerably accurate identification of malignant features with sensitivity and specificity reaching up to 91% in some studies.[3] The assignment of a scoring system for evaluation of an adnexal lesion has optimised the management in females with adnexal/ovarian lesions, leading to timely referral to oncologists in suspected malignancy and avoidance of unnecessary surgeries in benign masses.[4]

The presence of solid tissue within adnexal lesions and its enhancement is one of the most important determinants of malignancy, hence MRI remains the gold standard for imaging of borderline sonographic lesions. MRI O-RADS considers the presence or absence of locules, septae, papillary projections, evaluation of internal components, and their enhancement characteristics. Papillary projections are defined as solid protuberance from the wall or septae of the lesion with a branching configuration.[3] MR pelvis with dynamic contrast enhancement (DCE) is preferred for O-RADS, however in its absence, contrast uptake at 40 seconds relative to uterine myometrium is documented.[5] In fact, in ACR recommendation even the visual assessment of contrast uptake in a routine contrast enhanced pelvic MRI is approved.[6] This study aimed to evaluate adnexal lesions on MRI O-RADS for their characterization by application of a uniform system of reporting without any ambiguity, keeping the radiologists and gynaecologists on the same page; this would also in turn allow facilitation of speedy oncological referrals for patients with high MRI O-RADS grade.

Materials and Methods

Design of this study was cross sectional observational; it was conducted on 26 adult females suspected of having an adnexal mass and referred to Radiology department of CMH Abbottabad for MRI pelvis over a period of 12 months from September 2021 to August 2022. Non-probability consecutive sampling technique was used. Prior approval was taken from the Institutional Review Board (IRB) of the hospital No: CMHAtd/ETH-58-Radio-22, dated 31st August 2021. Inclusion criteria were age above 18 years, known adnexal lesion previously assessed by pelvic ultrasound, and normal renal function tests for administration of contrast. The exclusion criteria included females younger than 18 years, non-adnexal pelvic lesions, or patients whose diagnosis could not be followed up. MRI was performed on 1.5 Tesla GE machine and images were acquired in following sequences: T2-weighted, T1-weighted-with and without fat suppression, and T1-weighted after gadolinium injection with inclusion of diffusion-weighted functional sequence. The scans were interpreted by a senior Radiologist with experience of more than 15 years. Age, laterality, signal characteristics of lesion (soft tissue, fat, haemorrhage, calcification), papillary projection, septations, enhancement pattern and any ancillary findings such as omental deposits or ascites were recorded for each patient. Based on these findings, O-RADS was assigned to each lesion and findings were compared with sonographic results; follow up was done by serum tumor markers, surgery, or clinical outcome. Statistical Package for Social Sciences (SPSS v. 25.0) was used, and chi square was applied to compare the sonographic and MR O-RADS findings in keeping with the final diagnosis of the patient. In cases where the expected frequency of at least one cell was less than five, Fisher's exact test was applied. A *p* value of less than 0.05 with confidence interval (CI) of 95% was statistically significant.

Results

Age of the female patients recruited in this study ranged from 21-70 years with mean of 36.9 $\pm$ 11.1 years. Maximum referral (61.5%; n=16/26) was for the age group between 26-40 years; in this age group predominant O-RADS category fell between 2/3, while all malignant lesions (O-RADS 5) except for one occurred in ages more than 40 - Figure 1. Most of the pelvic lesions were unilateral in 57.7% patients (n=15/26); while maximum belonged to O-RADS category 3 (likely benign with very low probability of malignancy) in 69.2% (n=18/26) – Figure 2 (a/b). Malignant lesions (O-RADS 5) were detected in four patients; diagnosis in these patients was aided by

serum tumor markers/ follow up. Final diagnosis of these lesions among the patients on both ultrasound and MRI O-RADS is depicted in Figure 3. The discrepancy between sonographic grading of the lesions with MRI findings was found in lesions labelled as borderline/ suspicious for malignancy on ultrasound with MRI being definitive in comparison to ultrasound findings (p value *0.004). Benign findings and definitive malignant lesions on ultrasound were in keeping with MRI (confirmed through laboratory findings, treatment response or surgery). All lesions demonstrating haemorrhage on ultrasound were found to be O-RADS 2/3 on MRI (benign). Out of 11 complex lesions on ultrasound, only 2 (18.2%) turned out to be malignant (O-RADS 5) while rest were endometriomas/ hemorrhagic cysts (O-RADS 3)- with varying stages of bleed (9 out of 11 at 81.8%) In lesions having definite sonographic malignant components together with ancillary findings of ascites, omental thickening etc (2/23), MRI was confirmatory.

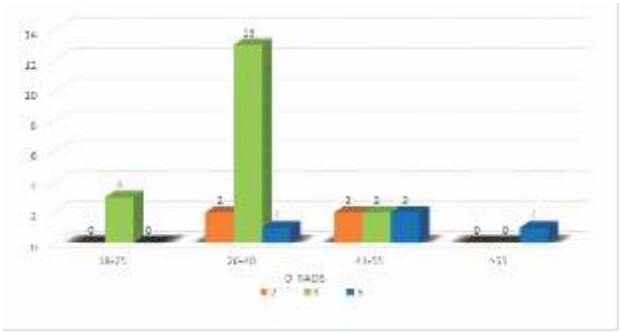
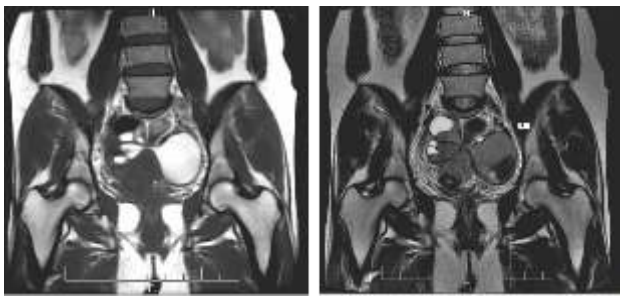


Figure 1: **Distribution of O-RADS within Age Groups- Predominantly Benign Lesions (O-RADS 2/3) Identified in Younger Age Group; Malignant Lesions (O-RADS 5) in Patients >40 yrs**



(a) **(b)**

Figure 2: (a)- T1 W Coronal Image of a 35-Year-Old Female Demonstrating High Signal in Adnexal Masses Representing Bilateral Endometrial Cysts; (b)- Corresponding Coronal T2W Images in the Same Patient Representing Varying Degrees of Haemorrhage.

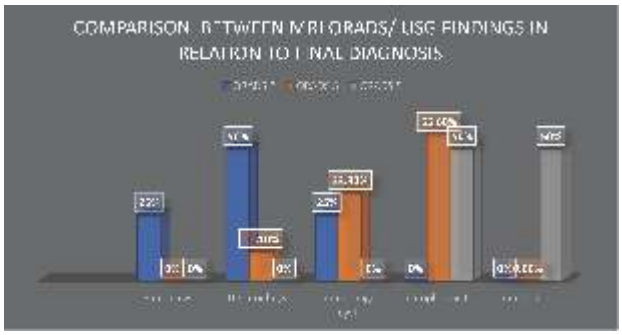


Figure 3: Final Diagnosis in Comparison to MRI O-RADS and USG Findings (% frequency)

Discussion

MRI O-RADS for pelvic masses has enabled the accurate characterization of lesions, particularly those which are found to be ambiguous on sonographic assessment resulting in timely referral and management of the patients. Although laboratory investigations such as serum tumor markers (CA-125) form part of the diagnostic protocol, there are a several shortcomings associated with these. In premenopausal women CA-125 can be raised in benign conditions such as endometriosis.[7] Moreover, it is raised only in 50% of cases in Stage I ovarian tumors hence is unreliable in initial diagnostic workup. Additionally, it is more commonly associated with serous than mucinous tumors.[8] These factors limit the diagnostic capability of this tumor marker. In post-menopausal women however, raised CA-125 is indicative of a malignant lesion and also used as a suitable marker for determining therapeutic efficacy post treatment.[9] MRI remains the gold standard for ascertaining the origin of pelvic lesions and for differentiation of benign from malignant etiology in sonographically indeterminate masses. In some studies, the incidence of indeterminate lesions has been found to be lowered from 18-31% on ultrasound to 10.8-12.5% on MR.[10] CT forms an important diagnostic tool in staging of the ovarian carcinoma and for assessment of associated abdominal complications.[11] PET CT is the gold standard for detecting recurrence of ovarian tumors post treatment however has no role in its initial management.[12]

Contrast enhanced MRI pelvis technique for evaluation of adnexal lesions has been modified to acquire the post contrast images in multiphase

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dynamic sequences for better characterization by plotting signal intensity curves,[13] however this is not widely available in all set ups. In our study, due to unavailability of dynamic enhancement technique, conventional contrast images were acquired. There are six risk score categories in the O-RADS MRI risk stratification system: O-RADS MRI 0 (incomplete examination), O-RADS MRI 1 (normal ovaries), O-RADS MRI 2 (almost certainly benign), O-RADS MRI 3 (low risk), O-RADS MRI 4 (intermediate risk), and O-RADS MRI 5 (high risk).[14]

Varwatte et al. compared ultrasound and MRI findings in adnexal lesions as a diagnostic tool; although no significant difference in accuracy was found between the two methods, the extent and epicentre were better determined using MRI.[15] This conformed to our study as well where no significant difference in accuracy was appreciated between USG and MRI pelvic findings.

Among benign lesions, endometriomas versus hemorrhagic cysts have been a diagnostic dilemma on ultrasound. 'T2 shading sign' previously thought to be specific for endometriomas has been assigned less diagnostic, as evidenced by a study by Lupean et al (68–93% sensitivity, 45–93% specificity).[16] In our study, 'T2 shading sign' was not reliable in differentiation of hemorrhage containing cysts (endometriomas versus hemorrhagic cysts) based solely on this sign- conforming to the international studies. The most important application of MRI O-RADS remained in the borderline cases on ultrasound, which improved the characterisation of such lesions aiding in their management, whereas MRI was found to have more specificity in lesion characterisation. MRI O-RADS provided adequate characterization of the lesions in all malignant cases which were confirmed on serology/ surgery. All of the O-RADS 5 cases had solid enhancing component, thick enhancing septae and had ancillary findings including ascites and/or omental thickening.

The limitations of this study include the small number of subjects. Also, some of the patients who were either lost to follow-up or whose definitive diagnosis could not be confirmed had to be excluded. Ultrasound O-RADS was not used in this study. A larger sample size and application of both MRI and USG O-RADS should be done in conjunction for better results.

Conclusion

Consistent application of MRI O-RADS in patients with adnexal lesions provides reliable and reproducible results in a standardized manner. MRI O-RADS is specifically important in characterizing sonographically indeterminate pelvic lesions to optimise patient referrals of malignant masses to oncologist and for prevention of unnecessary surgery and investigations in benign entities.

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CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

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DATA SHARING STATMENT

The data that support the findings of this study are available from the corresponding author upon request.