Orads MRI score for categorization of adnexal masses.

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ABSTRACT

Background: Adnexal masses are common, resulting in a significant clinical workload related to diagnostic imaging, surgery, and pathology. Most adnexal masses are benign, and most groups can be accurately categorized as benign or malignant on ultrasonography. Imaging plays a vital role in characterizing and risk-stratifying commonly encountered adnexal lesions. Recently, the American College of Radiology (ACR) released the Ovarian-Adnexal Reporting and Data System (O-RADS) for ultrasound and subsequently for magnetic resonance imaging (MRI). The goal of the recently developed ACR O-RADS MRI risk stratification system is to improve the quality of imaging reports and the reproducibility of evaluating adnexal lesions on MRI. This review focuses on exploring this new system and its future refinements. **Aim:** Evaluation of sonographically indeterminate adnexal masses by Ovarian Adnexal Reporting Data System Magnetic Resonance Imaging (O-RADS MRI) score. **Summary:** The O-RADS MRI risk score provides a stratification system for assigning the probability of malignancy to adnexal lesions based on MRI features using a stepwise approach. Its widespread use will improve radiologist reports, reproducibility, and communication between radiologists and clinicians/surgeons.
Keywords: Ovarian-Adnexal Reporting Data System Magnetic Resonance Imaging; Sonographically; Adnexal Masses

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INTRODUCTION

Adnexal masses are common, resulting in a significant clinical workload related to diagnostic imaging, surgery, and pathology. Most adnexal masses are benign, and most groups can be accurately categorized as benign or malignant on ultrasonography**.** However, between 18%and 31 adnexal masses remain indeterminate following ultrasonography using the ultrasound scoring system Simple Rules or other ultrasonography scoring systems (1)

The Ovarian-Adnexal Reporting and Data System (O-RADS) is a lexicon and risk stratification tool designed to accurately characterize adnexal lesions and is essential for optimal patient management. O-RADS is a recent addition to the American College of Radiology (ACR) reporting and data systems and consists of ultrasound (US) and MRI arms (2)

The ACR Ovarian-Adnexal Reporting and Data Systems (O-RADS) MRI Committee has developed an evidence-based lexicon and risk stratification system for MRI evaluation of adnexal lesions, employing the AdnexMR score. Using this score in

clinical practice may allow a tailored, patient-centered approach for sonographically indeterminate masses, preventing unnecessary surgery, less extensive surgery, or fertility preservation when appropriate while ensuring preoperative detection of lesions with a high likelihood of malignancy (3)

MRI can further characterize lesions seen on ultrasound to help decrease the number of false-positive lesions and avoid unnecessary surgery for benign lesions. The Ovarian-Adnexal Reporting and Data Systems MRI Committee was formed under the direction of the ACR to create a standardized lexicon for adnexal lesions to improve the quality and consistency of imaging reports (4)

The aim of the Work was to Evaluation of sonographically indeterminate adnexal masses by Ovarian Adnexal Reporting Data System Magnetic Resonance Imaging (O-RADS MRI) score.

ORADS Ultrasound Classification System

The Ovarian-Adnexal Reporting and Data System (O-RADS) lexicon for the US was published in 2018, providing a standardized glossary that includes all pertinent descriptors and definitions of the characteristic US appearance of normal ovaries and ovarian or other adnexal lesions. The dictionary is based on the consensus of the committee. (5)

Classification

O-RADS US 0: an incomplete evaluation

O-RADS US 1: Physiologic category (normal premenopausal ovary)

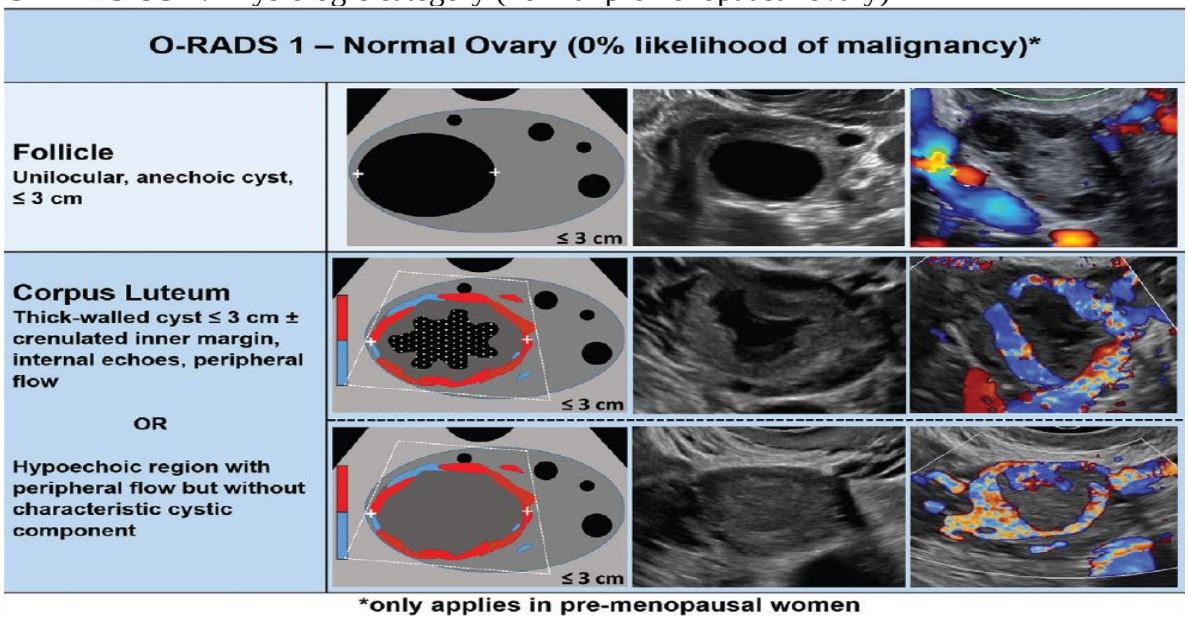

Figure 1: Image shows Ovarian-Adnexal Reporting and Data System (O-RADS) US category 1, normal ovary (6)

O-RADS US 2: Almost undoubtedly benign category (<1% risk of malignancy)

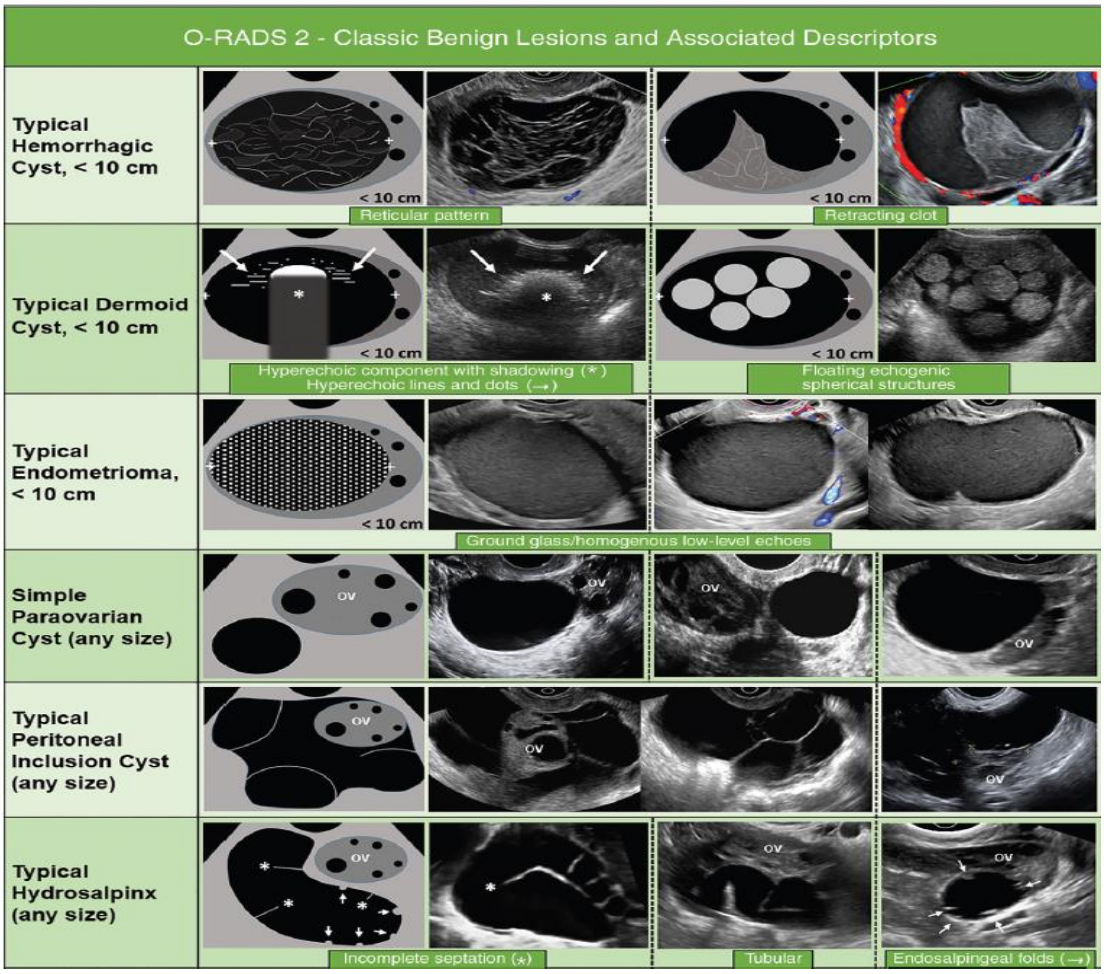

Figure 2: Image shows Ovarian-Adnexal Reporting and Data System (O-RADS) US category 2, classic benign lesions and associated descriptors. Ov = ovary. (7)

O-RADS US 3: Low risk of malignancy (1% to <10%) - needs a referral to ultrasound specialist or gynecologist with a view to MRI (8)

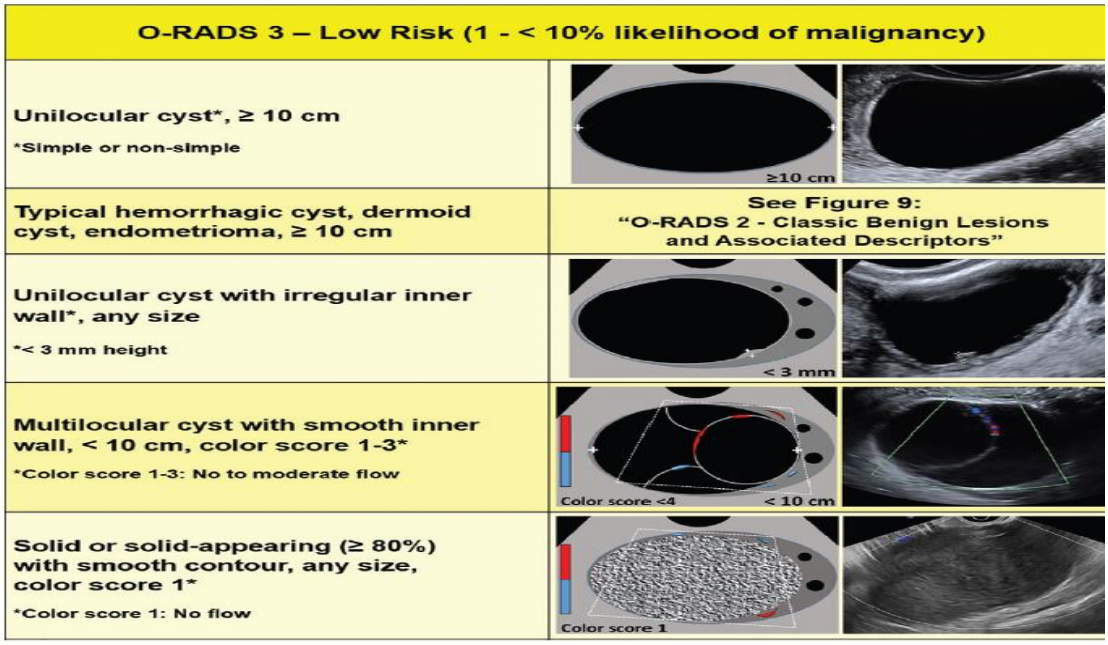

Figure 3: Image shows Ovarian-Adnexal Reporting and Data System (O-RADS) US category 3, low risk of malignancy (9)

O-RADS US 4: Lesions with an intermediate risk of malignancy (10% to <50%) - need ultrasound specialist review or MRI as well as management by a gynecologist with gynecological oncology support or solely by a gynecological oncologist (10)

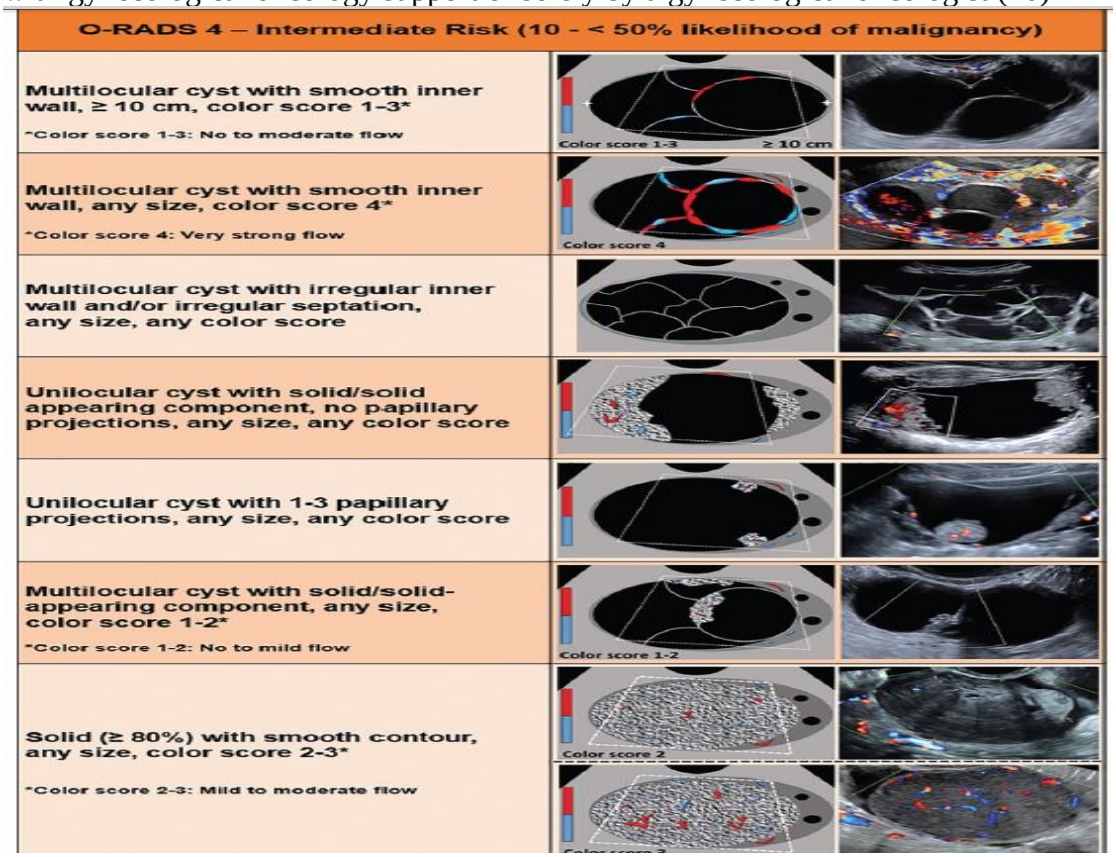

Figure 4: Image shows Ovarian-Adnexal Reporting and Data System (O-RADS) US category 4, intermediate risk of malignancy (11)

O-RADS US 5: Lesions with a high risk of malignancy (≥50%) - need a referral to a gynecological oncologist (12)

Color scoring (CS) indicator: CS1: no flow, CS2: minimal flow, CS3: moderate flow and CS4: strong flow

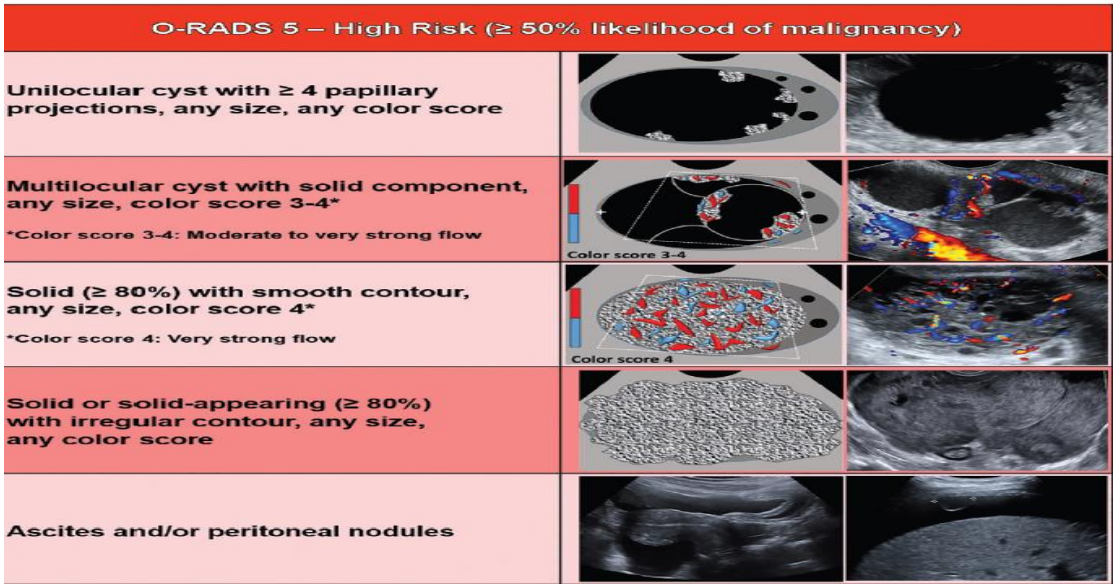

Figure 5: Image shows Ovarian-Adnexal Reporting and Data System (O-RADS) US category 5, high risk of malignancy (13)

Accurately characterizing ovarian and other adnexal masses is essential for optimal patient management. Conservative and less aggressive management is more appropriate for likely benign lesions. The ultimate goal is to optimize ovarian cancer outcomes while minimizing unnecessary surgical procedures in patients at low risk of malignancy.

ORADS MRI Classification System

The **Ovarian-Adnexal Reporting and Data System Magnetic Resonance Imaging (O-RADS MRI)** forms the MRI component of the Ovarian-Adnexal Reporting and Data System (O-RADS). This system aims to ensure a uniform, unambiguous MRI evaluation of ovarian or other adnexal lesions, accurately assigning each lesion to a risk category of malignancy being present, which informs the appropriate management to be instituted.

O-RADS MRI Risk Stratification System: Classification of Adnexal Lesions

O-RADS MRI Score 0: Adnexal lesions are classified as O-RADS MRI 0 when the lesion is incompletely evaluated at MRI. This may include lesions that are incompletely imaged, where portions of the lesion are not assessed; a technically inadequate MRI examination, where all the required imaging sequences have not been performed, or there is a large amount of artifact, are also included in this category. (14)

O-RADS MRI Score 1: In premenopausal women, when there is a physiologic observation such as follicles, hemorrhagic cysts, and corpus luteal cysts measuring 3 cm or less, the finding is not considered an adnexal lesion and can be classified as O-RADS MRI score 1 (15).

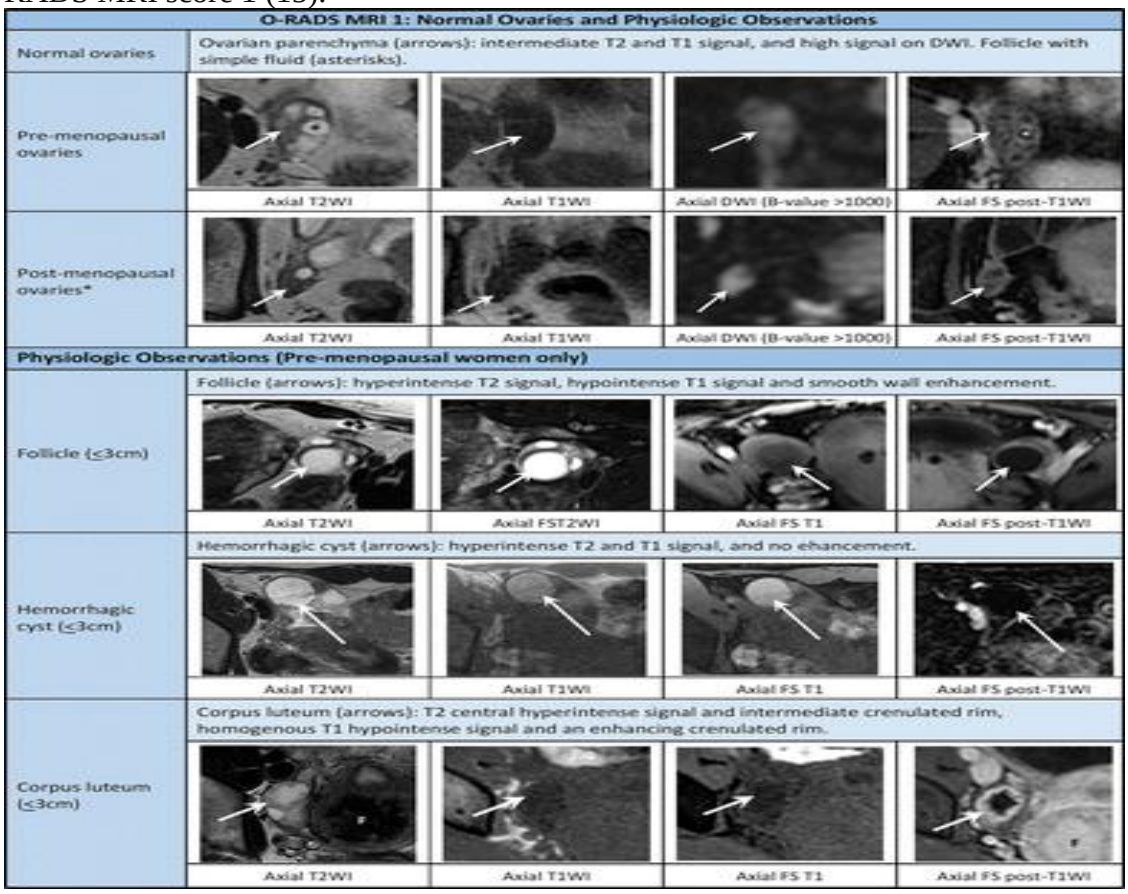

Figure 6: The image shows examples of Ovarian-Adnexal Reporting and Data System (O-RADS) MRI 1 risk score. * = In postmenopausal women, normal ovaries

can contain tiny residual follicles, and if the radiologist subjectively assesses the ovaries as normal, the ovaries can be categorized as O-RADS MRI 1. DWI = diffusion-weighted imaging, FS = fat saturated, T1WI = T1-weighted imaging, T2WI = T2-weighted imaging. (16)

O-RADS MRI Score 2

Adnexal lesions scored as O-RADS MRI 2 are considered almost undoubtedly benign, with a PPV for spite of less than 0.5% (Fig 7) (17).

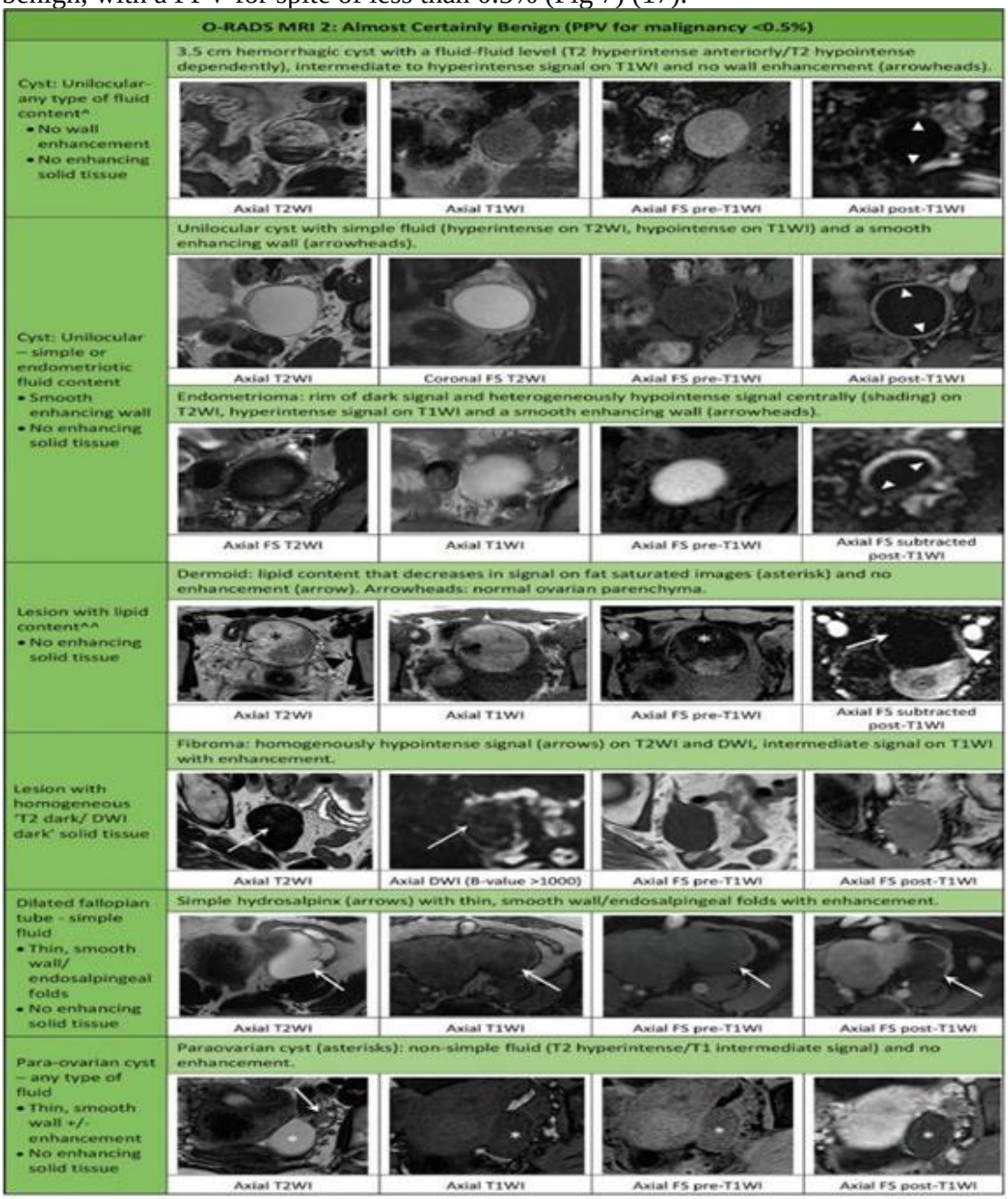

Figure 7: The image shows examples of Ovarian-Adnexal Reporting and Data System (O-RADS) MRI 2 risk score. ^ = Unilocular cysts with simple or hemorrhagic fluid 3 cm or smaller in a premenopausal woman would be classified as O-RADS MRI 1. ^^ = Minimal enhancement of Rokitansky nodule in lesion containing lipid does not change to O-RADS MRI 4. DWI = diffusion-weighted imaging, FS = fat saturated, PPV = positive predictive value, T1WI = T1-weighted imaging, T2WI = T2-weighted imaging. (18)

O-RADS MRI Score 3: Adnexal lesions classified as O-RADS MRI 3 are considered low risk for malignancy, with a PPV of approximately 5% (Fig 8). (19)

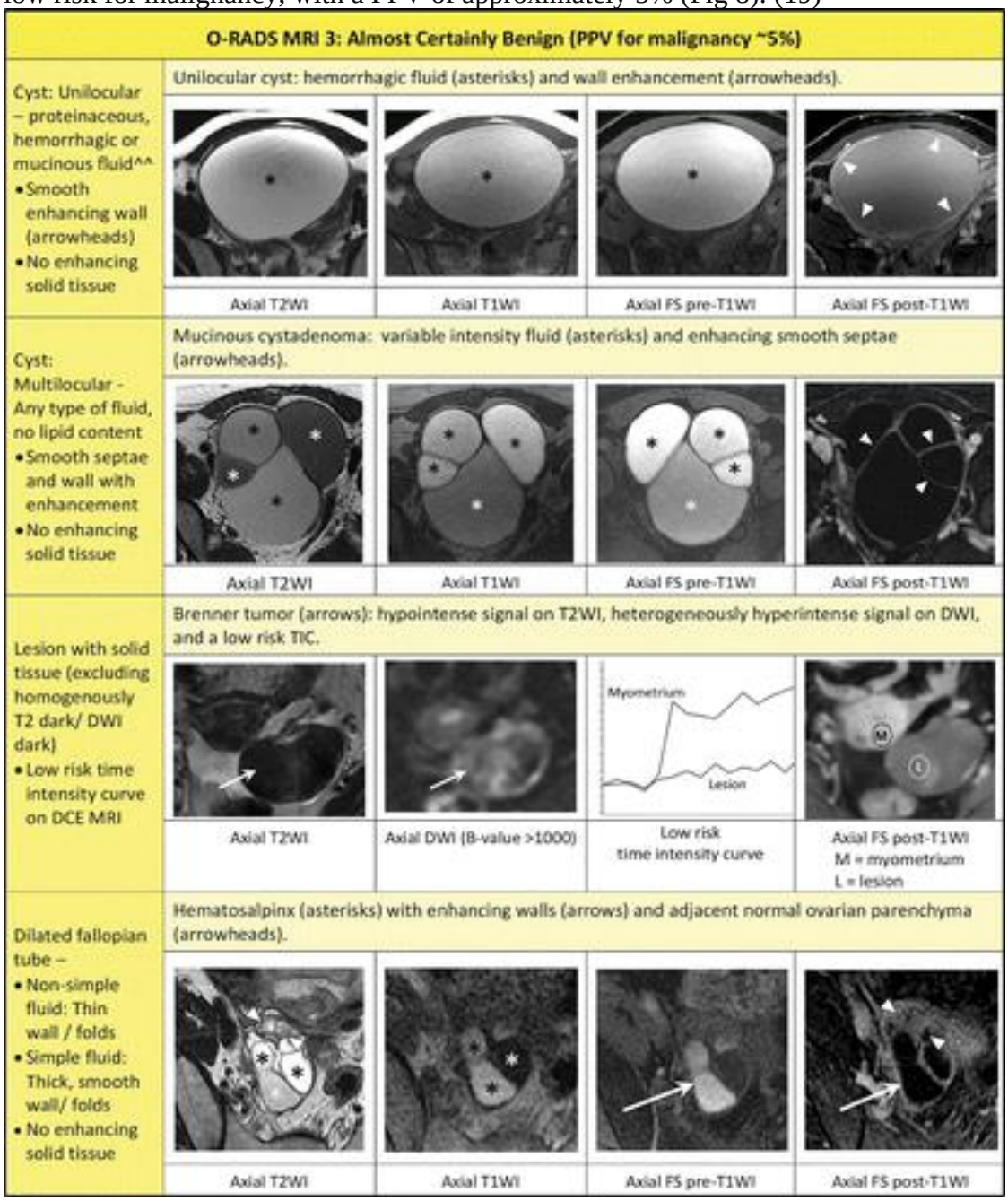

Figure 8: The image shows examples of Ovarian-Adnexal Reporting and Data System (O-RADS) MRI 3 risk score. ^^ = Hemorrhagic cyst smaller than 3 cm in a premenopausal woman would be classified as O-RADS MRI 2. DCE = dynamic contrast-enhanced, DWI = diffusion-weighted imaging, FS = fat-saturated, PPV = positive predictive value, TIC = time-intensity curve, T1WI = T1-weighted imaging, T2WI = T2-weighted imaging (20)

O-RADS MRI Score 4: Adnexal lesions with an O-RADS MRI score of 4 are considered intermediate risk for malignancy, with a PPV of approximately 50% (Fig 9). (3)

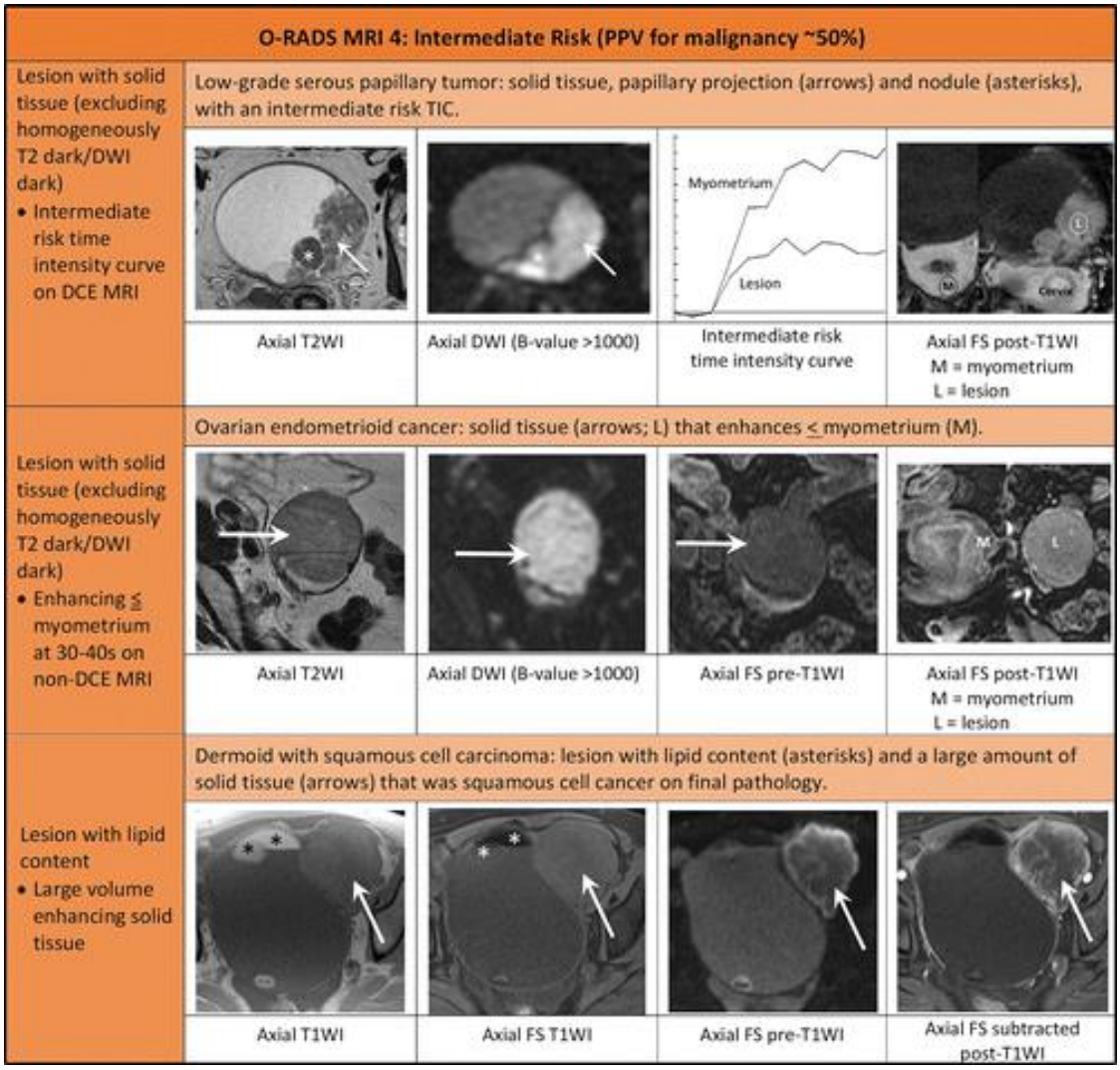

Figure 9: The image shows examples of Ovarian-Adnexal Reporting and Data System (O-RADS) MRI 4 risk score. DCE = dynamic contrast-enhanced, DWI = diffusion-weighted imaging, FS = fat-saturated, PPV = positive predictive value, TIC = time-intensity curve, T1WI = T1-weighted imaging, T2WI = T2-weighted imaging. (21)

Lesions in this category contain solid tissue (excluding T2 dark/DWI dark lesions) that exhibit the intermediate-risk TIC. Data have shown that lesions with an intermediate TIC have a PPV of 46.6%. If DCE MRI is not feasible, lesions with solid tissue (excluding T2 dark/DWI dark lesions) that enhance less than or equal to the myometrium at 30–40 seconds after contrast material injection on non-DCE MRI scans can be placed in this category. Because the definition of intermediate-risk TIC is based on a very early enhancement that is not as steep as that of the myometrium (20)

O-RADS MRI Score 5: Adnexal lesions classified as O-RADS MRI score five are considered at high risk for malignancy, with a PPV of approximately 90% (Fig 10). (22)

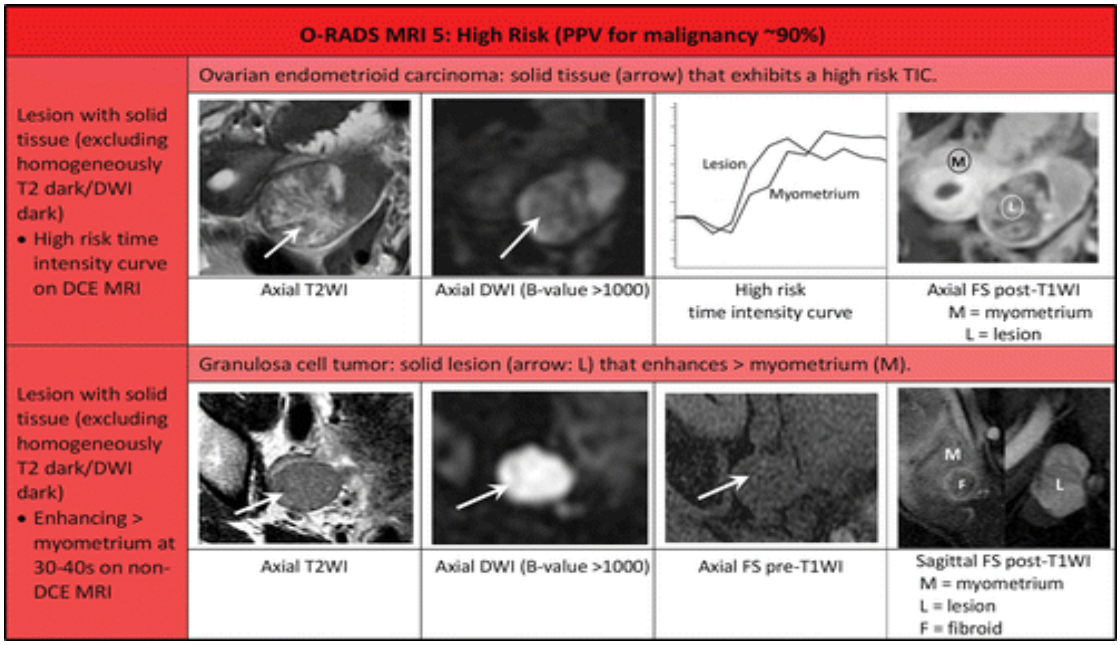

Figure 10: The image shows examples of Ovarian-Adnexal Reporting and Data System (O-RADS) MRI 5 risk score. DCE = dynamic contrast-enhanced, DWI = diffusion-weighted imaging, FS = fat-saturated, PPV = positive predictive value, TIC = time-intensity curve, T1WI = T1-weighted imaging, T2WI = T2-weighted imaging. (3)

This category includes lesions with solid tissue (excluding T2 dark/DWI dark lesions) that exhibit a high-risk TIC and the presence of peritoneal and omental deposits. Data have shown that lesions with a high-risk TIC have a PPV of 85.6%. If DCE MRI is not feasible, lesions with solid tissue (excluding T2 dark/DWI dark lesions) that enhance greater than the myometrium at 30–40 seconds after contrast material injection at non-DCE MRI can be placed in this category. As the definition of high-risk TIC is based on very early enhancement steeper than that of the myometrium, in the absence of DCE, the ACR O-RADS MRI committee decided to classify lesions that enhance greater than the myometrium at 30–40 seconds as O-RADS MRI score 5. (18)

Limitations of DCE MR imaging: A significant amount of solid tissue is needed to generate a time-intensity curve. Time-intensity curves obtained with small solid-tissue components can be limited by the partial volume effect of adjacent structures**. (23)**

False-negative results may occur with poorly vascularized malignant tumors, and false-positive enhancement characteristics may be seen in benign lesions with a high blood supply, such as tubo-ovarian abscess, which may appear complex and indeterminate with all imaging modalities.

Challenges of the O-RADS MRI risk stratification system in clinical practice

As with any new approach, there are challenges to implementing and using the O-RADS MRI risk stratification system. These include implementing the appropriate MRI technique and acquiring the knowledge of tissue and fluid differentiation at MRI in practices not familiar with using MRI for adnexal lesion characterization.

Developing an MRI protocol to include the necessary sequences, particularly DCE MRI, can be challenging in some centers. In centers where DCE is not possible due to time constraints or lack of perfusion curve analysis software, analysis of the enhancement of the solid tissue on the 30–40-second post-contrast series can be performed as a substitute.

Understanding how to characterize cystic and solid components and differentiate enhancing tissue from other solid parts at MRI are the essential diagnostic skills that must be acquired to use this system. This takes time, investment and resources, which can be difficult to find in a busy clinical practice. The availability of the O-RADS MRI calculator can help facilitate the integration of imaging findings and the assignment of the O-RADS MRI risk score. (18)

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