Original Article

The Ovarian-Adnexal Reporting And Data System (O-RADS) And Adnexal Masses

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Abstract

Background: The use of grayscale ultrasound with Doppler mea¬surements allows the experienced sonogra¬pher to reliably diagnose functional, benign, and malignant adnexal masses. Information obtained from pelvic ultrasound, with the patient's history and gynecologic exam, guides recommendations for treatment, mainly the decision for conservative follow-up or surgery.The Ovarian-Adnexal Reporting and Data System (O-RADS) US risk stratification and management system provide consistent interpretations to eliminate ambiguity in US reports which results in a higher probability of accuracy in the assessment 0f risk of malignancy to ovarian and other adnexal masses and also to provide a management recommendation for each risk category. This study aimed to evaluate the Importance of using the O-RADS classification system US in the diagnosis of suspicious ovarian mass lesions. The O-RADS US classification system must help the healthcare provider decide which lesions require no follow-up or conservative follow-up, also with the aid of a US specialist for optimal characterization, versus lesions that require consultation with a gynecologist or gynecologic oncologist

Keywords: The Ovarian-Adnexal Reporting and Data System (O-RADS)

INTRODUCTION

The use of grayscale ultrasound with Doppler measurements allows the experienced sonographer to reliably diagnose functional, benign, and malignant adnexal masses. Information obtained from pelvic ultrasound, with the patient's history and gynecologic exam, guides recommendations for treatment, mainly the decision for conservative follow-up or surgery **(1).**

Physiological, peritoneal and tubal cystic pathology

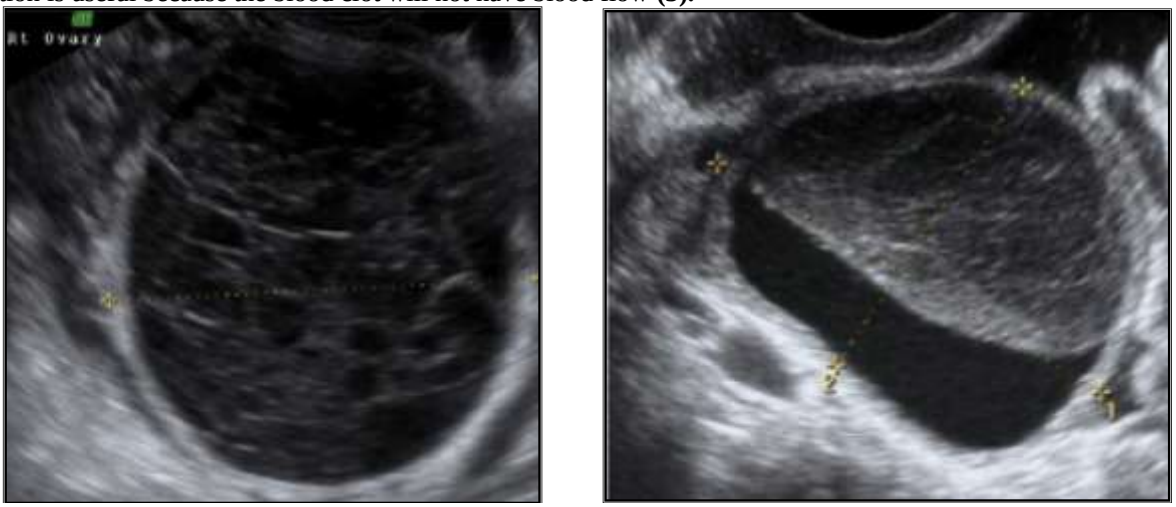
Follicular cysts

They are usually thin-walled and unilocular with anechoic contents. They usually don't exceed 8–10 cm in diameter and spontaneously resolve within 6 weeks. The most important feature of it is the Posterior wall hyperechoic enhancement due to the reflection of the ultrasound beam travelling through the anechoic window formed by the clear cyst contents.

Fig. (1): 'Physiological' cyst of the follicle. Note the bright white hyperechoic enhancement of the posterior wall. **(2).**

Corpus luteum cysts

They are thick-walled hyperechoic cysts and typically have a peripheral ring-shaped blood flow, sometimes known as the 'ring of fire'. Some cysts have areas of internal hemorrhage. The cyst contents is a spider-web-like appearance due to a tiny amount of internal hemorrhage but may show different features such as blood clots within the cyst resembling solid components. Doppler examination is useful because the blood clot will not have blood flow **(3).**



A B

Fig. (2): The cobweb sign, which represents the fibrin strings of a recently formed clot within a hemorrhagic corpus luteum cyst (A), and after clot retraction (B) **(2).**

Peritoneal pseudocysts

These are collections of peritoneal fluid present in adhesions usually caused by previous pelvic surgery, endometriosis, or pelvic inflammatory disease. They mostly occur in premenopausal women, due to the presence of functional ovaries which release small amounts of fluid into the peritoneal cavity. Pseudocysts usually appear as multilocular cysts, with a large number of septa that adhere to the ovarian surface. The septa are mostly complete and thin. Unlike septae within true ovarian cysts, the septae in pseudocysts move and 'flap' when the cystic area is prodded by the transvaginal ultrasound probe. This is described as the 'flapping sail sign'. They are irregular in shape, that follow the contours of the pelvic sidewall or Douglas Pouch and surrounding pelvic organs, giving a 'lumpy', 'star-like' or 'tubular' appearance **(4).**

Fig. (3): Multilocular peritoneal inclusion cysts **(2).**

Paraovarian cysts

Paraovarian cysts appear as thin-walled unilocular anechoic masses that are usually close to but separate from the ovary. They can show papillary projections in about 30% of cases. Their mean diameter was <5 cm with no evidence of follicles or vascularity. In almost all cases, the ipsilateral ovary is normal and can detect cyst movement in the opposite direction to the ovary when the area is pushed with the vaginal probe, the 'split sign'. This helps to differentiate between paraovarian and ovarian cysts when the ipsilateral ovary is not visible **(4).**

Fig. (4): A paraovarian cyst with a normal ovary seen separate from it **(2).**

Tubal pathology

A normal fallopian tube is not visualized during the ultrasound examination. Hydrosalpinxes have their typical diagnostic features on ultrasound, which are anechoic contents and incomplete septae **(5).**

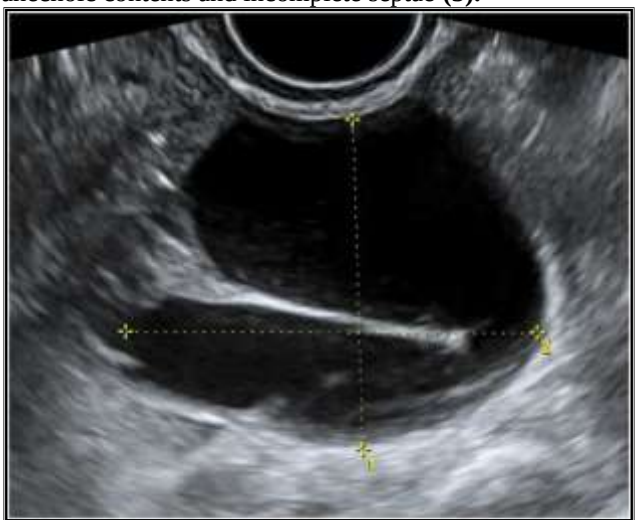
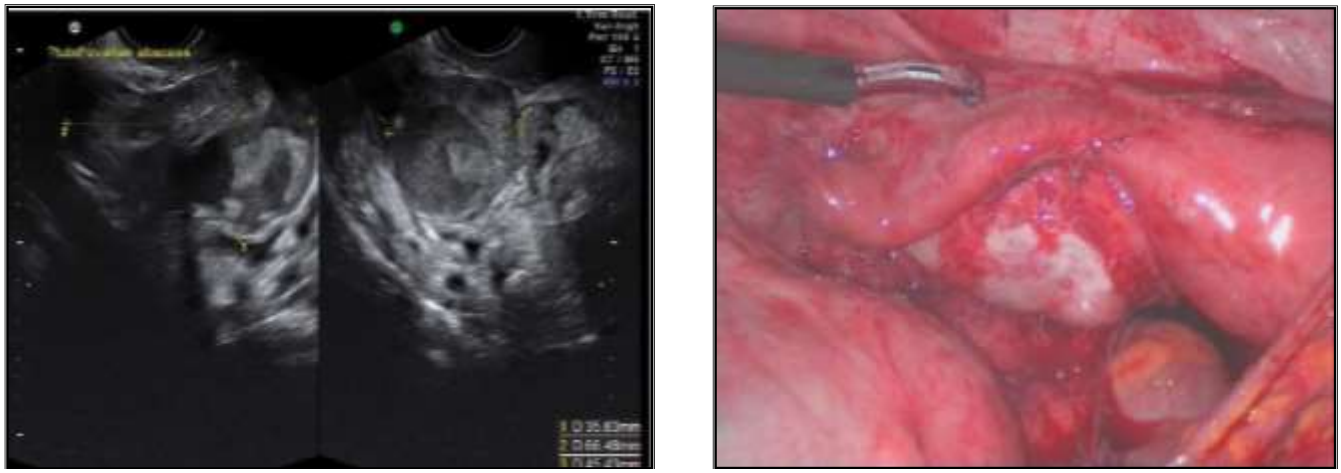


Fig. (5): Incomplete septum in a hydrosalpinx **(2).**

Acute salpingitis usually appears as a pear-shaped unilocular mass with anechoic content, characterized by thickening of the wall (>5 mm) and the presence of incomplete septa. In the transverse section, it shows the well-described 'cogwheel sign' appearance. Color or power Doppler examination usually shows significant vascularity in cases of an acute inflammatory process, as well as the presence of fluid in the Douglas pouch **(5).**

Fig. (6): The cogwheel sign **(2).**

In chronic salpingitis, the tube appears as an elongated fluid-filled mass, in addition to the presence of incomplete septa, and the thickening of the wall is no longer visible. It is characterized by the 'beads on a string sign', due to hyperechoic structures of 2–3 mm in size on the tubal wall, seen in the transverse section. A tube-ovarian complex represents the participation of ovarian tissue in the inflammatory process. Normal ovarian parenchyma is visible, but it is usually seen separately from tubal structures. In practice, the clinical features associated with an abscess make the diagnosis relatively straightforward **(5)**



A B

Fig. (7): A tube-ovarian complex. (A) Ultrasound appearances. (B) The same case at laparoscopy **(2).**

Ovarian pathology

Serous cystadenomas

These appear as thin-walled, smooth, anechoic, fluid-filled structures. They are bilateral in 15% of cases and their mean size is (5–8 cm). Some contain fine septations, and others have areas of hemorrhage that appear as small echogenic areas **(2).**

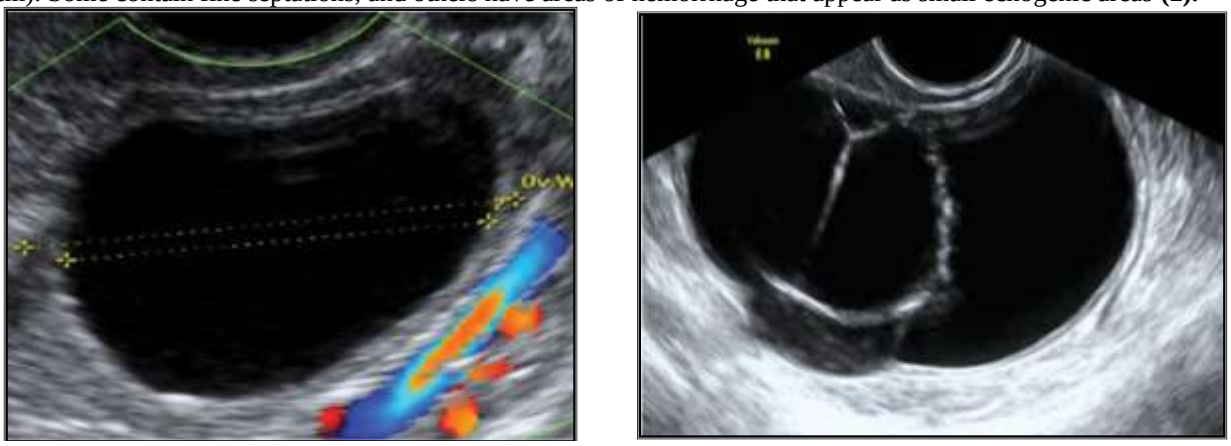


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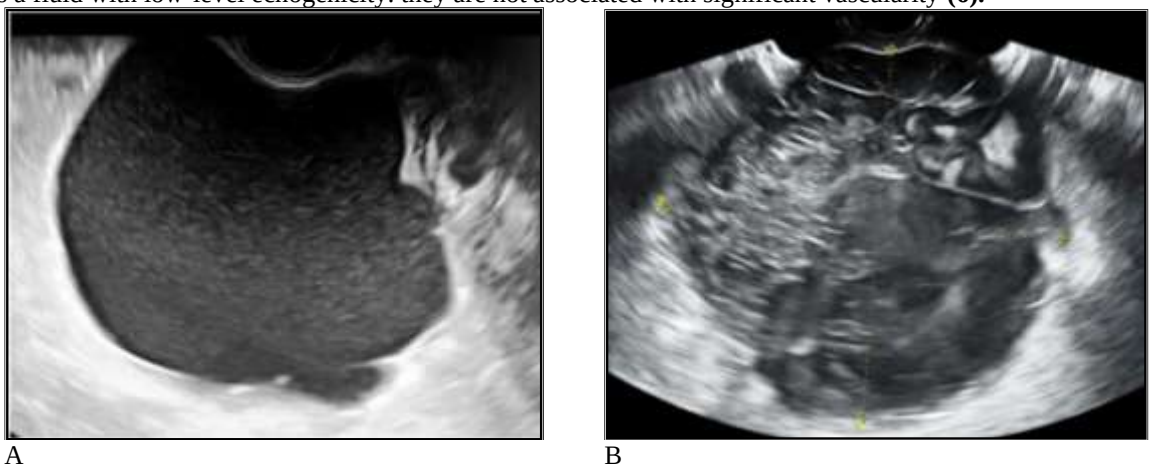
Fig. (8): Serous cystadenoma. (A) Unilocular serous cystadenoma. (B) Multilocular cystadenoma **(2).**

Mucinous cystadenomas

Mucinous cysts are typically thin-walled, large and unilateral. They consist of thin-walled internal loci containing mucin that appears as a fluid with low-level echogenicity. they are not associated with significant vascularity **(6).**



A B

Fig. (9): Mucinous cystadenomas. (A) Unilocular. (B) Multilocular **(2).**

Cystadenofibromas

Cystadenofibromas are a relatively rare type of benign epithelial ovarian tumor. The sonographic features of cyst-adenofibromas are limited. They may appear as unilocular solid masses or, less frequently, multilocular solid masses with thin cyst walls and anechoic contents. They have solid hyperechoic components with acoustic shadows with low to moderate vascularity. The key

feature to look for them is acoustic shadowing even within these small papillations **(7).**

A

B

C

Fig. (10): Serous cystadenofibromas. (A) Unilocular solid with papillary projection and acoustic shadows. (B) Multilocular solid. (C) Another example of serous cystadenofibroma with solid unilocular solid morphology **(2).**

Mature teratoma/dermoid cysts

Mature cystic teratomas are benign germ-cell tumors. They are typically cystic and unilocular in the majority of cases, with mixed echogenicity representing the different components of fat, bone, and fluid. The specific feature of dermoid cysts is a Rokitansky nodule, a distinct hyperechoic mural nodule that represents floating areas of hair in the low-density fluid. There are usually bright echoes and sharp acoustic shadows with hair or even teeth in the cyst **(8).**

A

B

C

Fig. (11): Ultrasound features of dermoid cysts. (A) Rokitansky nodule with strong acoustic shadow. (B) Acoustic shadows and

bright echoes representing hair in the cyst. (C) Unusual but the interesting presentation of a dermoid cyst which has been described as 'floating balls' - secondary to hyperechoic intracystic fat balls **(2).**

Endometriomas

Ultrasonography is sensitive to the diagnosis of 'typical' endometriomas, typically an endometrioma is a unilocular tumor and has low-level echogenicity that represents old blood in its cystic cavity (commonly termed 'ground glass'). It is this 'ground glass' feature that is the most typical feature **(2).**

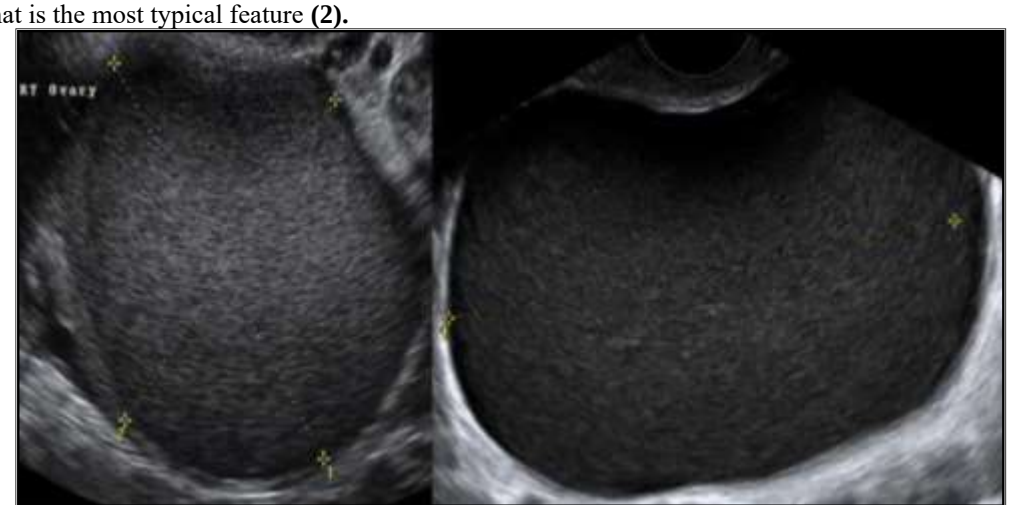
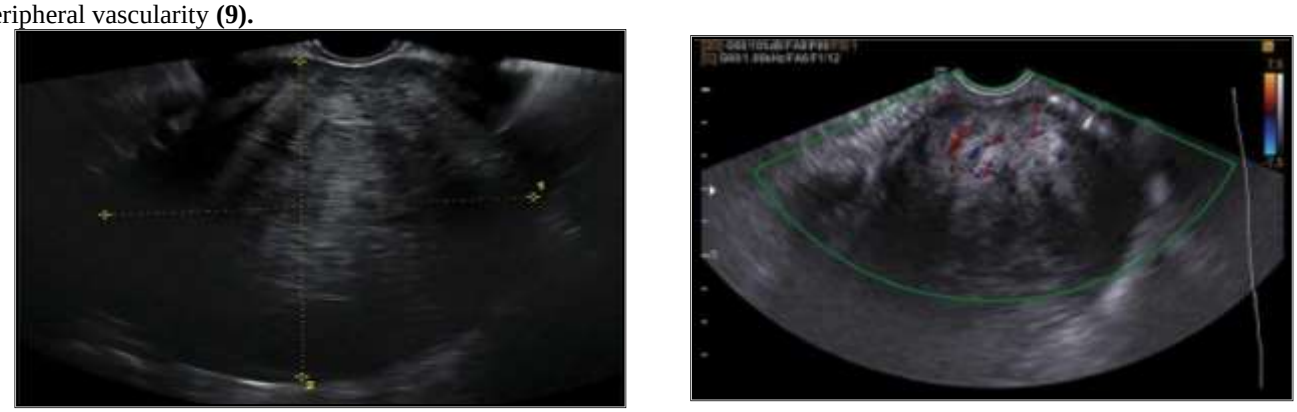


Fig. (12): Typical endometriomas **(2).**

Ovarian fibromas and fibrothecomas

These are benign tumors of stromal origin. Their characteristic sonographic appearance is a round or oval solid tumor, and regular margins. They occasionally have stripy acoustic shadows. Fibromas and fibrothecomas can also show cystic areas, due to edema, hemorrhage, or necrosis within the stromal tissue. Doppler findings are not specific, but frequently lesions show little peripheral vascularity **(9).**



A B

Fig. (13): Typical round regular ovarian fibroma with (A) acoustic shadows and (B) minimal peripheral **(2).**
Vascularity on color Doppler.

<u>Ovarian stromal tumors (struma ovarii)</u>

Struma ovarii is a rare subtype of mature teratoma diagnosed by the presence of ectopic thyroid tissue. They account for <5% of mature teratomas. They have been described as having a similar appearance to mature teratomas, but with increased vascularity in the central part of the mass. They are difficult to classify, but they have been associated with a sonographic sign called the 'struma pearl'. These are rounded hyperechogenic structures with smooth surfaces, with increased vascularity on Doppler examination **(4).**

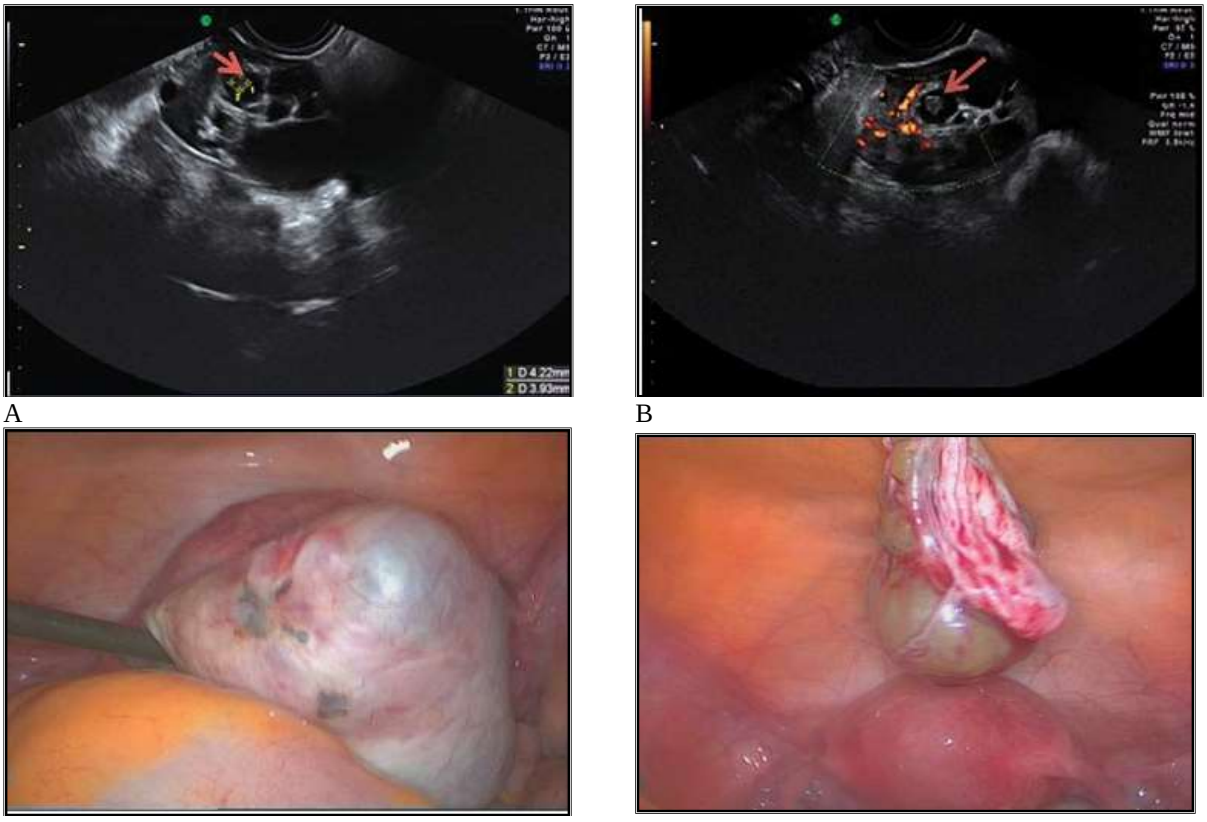


Fig. (14): Struma ovarii showing (A) multilocularity and formation of struma pearls (arrow) and (B) central vascularity (arrow pointing toward the 'pearl'). (C and D) Laparoscopic characteristics of the same cyst at the time of cystectomy **(2).**

Brenner tumors

Brenner tumors arise from the ovarian stroma, but are benign in most cases. They are usually small and usually coexist with serous or mucinous cystadenomas. They are mostly unilateral, within the left ovary. Brenner tumors may be associated with acoustic shadowing and may be confused with an ovarian fibroma or pedunculated fibroid of the uterus **(3).**

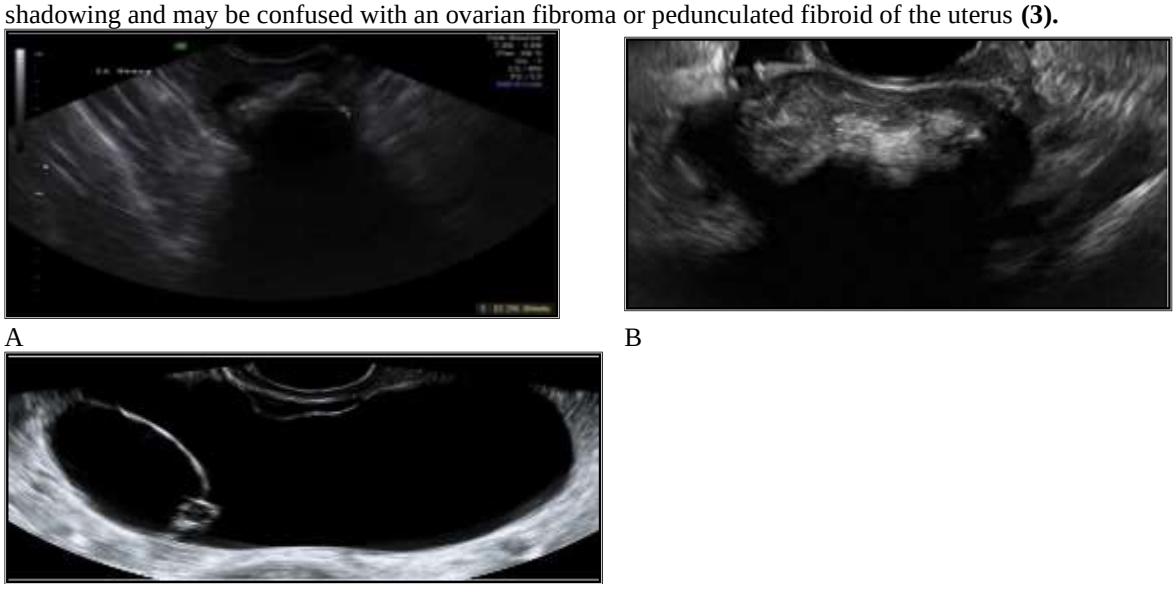


Fig. (15): Brenner tumors. (A and B) Solid Brenner tumor with marked acoustic shadowing. (C) Brenner tumor with mucinous cystadenoma **(2).**

The Ovarian-Adnexal Reporting and Data System (O-RADS)

The Ovarian-Adnexal Reporting and Data System (O-RADS) US risk stratification and management system provide consistent interpretations to eliminate ambiguity in US reports which results in a higher probability of accuracy in the assessment 0f risk of malignancy to ovarian and other adnexal masses and also to provide a management recommendation for each risk category. This study aimed to evaluate the Importance of using the O-RADS classification system US in the diagnosis of suspicious ovarian mass lesions **(10).**

Risk Stratification Methodology

Based on expert opinion, a working group of O-RADS US defined six categories for risk classification. These are

- O-RADS 0: is an incomplete evaluation.
- ORADS 1: includes the physiologic category (normal premenopausal ovary).
- O RADS 2: is a benign category (1% risk of malignancy).
- O-RADS 3: lesions with low risk of malignancy (1% to 10% risk of malignancy).
- O-RADS 4: lesions with intermediate risk of malignancy (10% to 50% risk of malignancy).
- O-RADS 5: lesions with a high risk of malignancy (>50% risk of malignancy) **(11).**

O-RADS US RISK Stratification and Management Strategy

1) Recommendations should act as guidance rather than as requirements for the management of patients with ovarian masses and other adnexal masses. Individual case management may be modified by professional judgment, according to the O-RADS US.
2) The management system is based on a patient with no acute symptoms and no substantial risk factors for ovarian cancer, such as a significant family history of ovarian cancer or the BRCA gene mutation. If these factors are present, the management may vary in this system.
3) The participation of a US specialist, whose practice focuses on the US assessment of adnexal lesions, has been added to the O-RADS US system.
4) Each patient will be classified as postmenopausal or premenopausal.
5) The size of the lesion, which is an important element in risk assessment, should be obtained by measuring the largest diameter of the lesion according to the plane in which that diameter appears **(12).**

O-RADS Categories

- **O-RADS 0:** is an incomplete evaluation due to technical factors such as the large size of the lesion, bowel gas, location of the adnexa, or inability to tolerate endo-vaginal imaging.
- **O-RADS 1:** The physiological category that is seen only in premenopausal patients, includes the follicle and corpus luteum. To prevent misunderstanding by patients, it is recommended that the US report describe this category as a follicle and corpus luteum rather than a cyst.
- **O-RADS 2:** This is typically a benign category (<1% risk of malignancy), including the majority of unilocular cysts less than 10 cm. This group includes simple cysts, non-simple unilocular cysts with smooth walls, and cysts that may be described using classic benign lesions and less than 10 cm in maximal diameter. Typically, benign lesions include those that can be accurately diagnosed when one or more specific O-RADS US lexicon descriptors are seen without any concerning features. These include the typical hemorrhagic cyst, endometrioma paraovarian cyst, dermoid cyst, peritoneal inclusion cyst, and hydrosalpinx. Although the color score (the abbreviated lexicon) is not included in the evaluation of lesions in the O-RADS 2 category, it is an important part of the evaluation of lesions in the higher-risk categories **(13).**
- **O-RADS 3:** the low-risk category (1% to, 10% risk of malignancy), includes lesions in the almost certainly benign category but are larger, and other lesions where descriptors apply showing a slightly higher risk of malignancy. This includes both simple cysts, smooth non-simple unilocular cysts, and lesions with classic benign descriptors that are greater than or equal to 10 cm. Also included are unilocular cysts with irregular wall thickness, multilocular cysts less than 10 cm without solid component with a color score less than 4, and also solid or solid-appearing avascular lesions with a smooth external contour of any size. Starting from the O-RADS 3 category, the color score becomes incorporated into the risk stratification system.
- **O-RADS 4:** refers to the intermediate-risk category (10% to 50% risk of malignancy), including the descriptors found to be predictive of a higher risk of malignancy. This includes unilocular and multilocular cysts of any size with a solid component or color score up to 4, multilocular cysts that are greater than or equal to 10 cm, or have an irregular inner wall or septal irregularity (3 mm in height), and smooth solid lesions (80% solid) with a color score of 2–3.
- **O-RADS 5**: the high-risk category (>50% risk of malignancy), and it comprises descriptors that are highly predictive of malignancy, including irregular solid lesions and multilocular cysts with a solid component and high color score. The presence of ascites and/or peritoneal nodules also indicates an O-RADS 5 score except when there are ascites in association with a physiological cyst or almost certainly benign lesion **(14).**

Table (1): Ovarian-Adnexal Reporting and Data System (O-RADS) US risk stratification and management system **(10).**

O-RADS Score	Risk Category [IOTA Model]	Lexicon Descriptors		Management	
				Pre-menopausal	Post-menopausal
0	Incomplete Evaluation [N/A]	N/A		Repeat study or alternate study	
1	Normal Ovary [N/A]	Follicle defined as a simple cyst ≤ 3 cm		None	N/A
		Corpus Luteum ≤ 3cm			
2	Almost Certainly Benign [< 1%]	Simple cyst	≤ 3 cm	N/A	None
			> 3 cm to 5 cm	None	Follow up in 1 year. *
			> 5 cm but < 10 cm	Follow up in 8 - 12 weeks	
		Classic Benign Lesions	See **Figure 3** for separate descriptors	See **Figure 3** for management strategies	
		Non-simple unilocular cyst, smooth inner margin	≤ 3 cm	None	Follow up in 1 year * If concerning, US specialist or MRI
			> 3 cm but < 10 cm	Follow-up in 8 - 12 weeks If concerning, US specialist	US specialist or MRI
3	Low Risk Malignancy [1-<10%]	Unilocular cyst ≥ 10 cm (simple or non-simple)		US specialist or MRI Management by gynecologist	
		Typical dermoid cysts, endometriomas, hemorrhagic cysts ≥ 10 cm			
		Unilocular cyst, any size with irregular inner wall <3 mm height			
		Multilocular cyst < 10 cm, smooth inner wall, CS = 1-3			
		Solid smooth, any size, CS = 1			
4	Intermediate Risk [10- < 90%]	Multilocular cyst, no solid component	≥ 10 cm, smooth inner wall, CS = 1-3	US specialist or MRI Management by gynecologist with GYN-oncologist consultation or solely by GYN-oncologist	
			Any size, smooth inner wall, CS = 4		
			Any size, irregular inner wall and/or irregular septation, any color score		
		Unilocular cyst with solid component	Any size, 0-3 papillary projections, CS = any		
		Multilocular cyst with solid component	Any size, CS = 1-2		
		Solid	Smooth, any size, CS = 2-3		
5	High Risk [≥ 90%]	Unilocular cyst, any size, ≥ 4 papillary projections, CS = any		GYN-oncologist	
		Multilocular cyst with solid component, any size, CS = 3-4			
		Solid smooth, any size, CS = 4			
		Solid irregular, any size, CS = any			
		Ascites and/or peritoneal nodules**			

Management

The O-RADS US classification system must help the healthcare provider decide which lesions require no follow-up or conservative follow-up, also with the aid of a US specialist for optimal characterization, versus lesions that require consultation with a gynecologist or gynecologic oncologist **(15).**

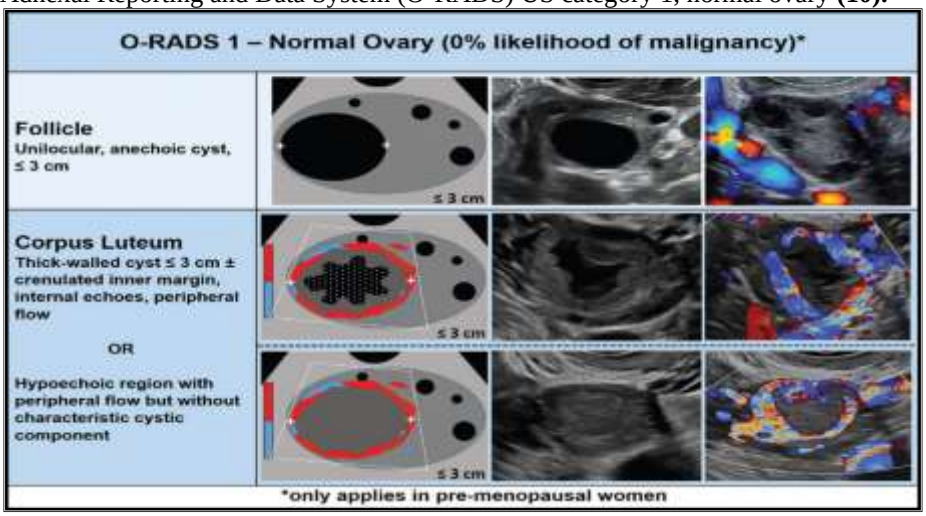
O-RADS 0, Incomplete evaluation

Generally, a repeat US is recommended, although an alternate imaging study such as MRI may be appropriate in these selected cases.

O-RADS 1, normal ovary

No additional imaging or imaging follow-up is necessary.

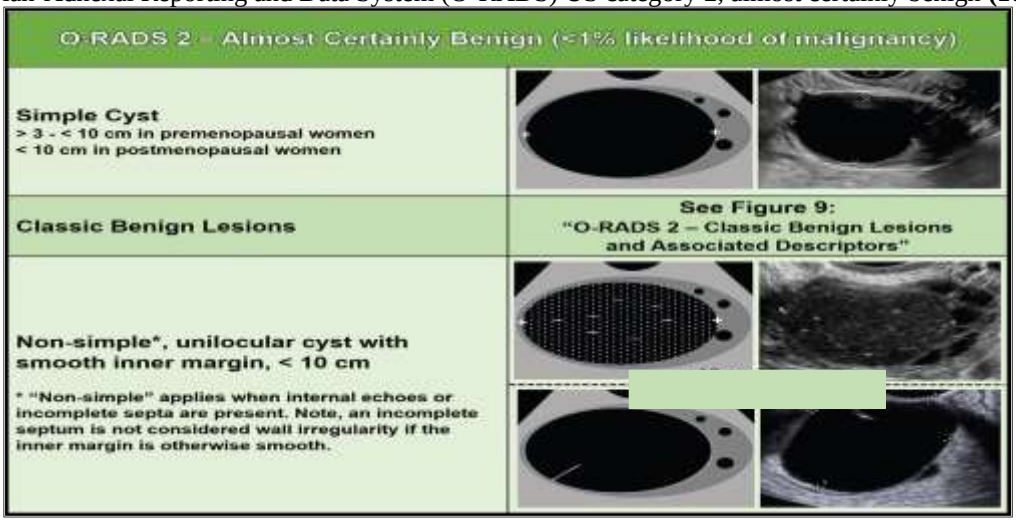
Table (2): Ovarian-Adnexal Reporting and Data System (O-RADS) US category 1, normal ovary **(10).**



O-RADS 2, Almost Certainly Benign (<1% Risk of Malignancy)

Generally, there is no follow-up or surveillance as a recommendation for lesions that are almost certainly benign. Characterization by a US specialist, as well as management by a gynecologist, may be advised in some subgroups.

Table (3): Ovarian-Adnexal Reporting and Data System (O-RADS) US category 2, almost certainly benign **(10).**



Simple Cysts

There is no additional management is required for simple cysts less than or equal to 5 cm in diameter in premenopausal patients, and those less than or equal to 3 cm should be considered physiologic (consistent with normal physiology, i.e., follicles).

It is reasonable in the premenopausal patient to recommend a follow-up in 8–12 weeks for cysts greater than 5 cm but less than 10 cm to confirm their functional nature or to indicate abnormalities in the cyst wall (more easily missed in cysts approaching 10 cm). In general, the proliferative phase is the time for re-evaluation, allowing functional cyst involution to occur following menstruation. If the cyst enlarges or persists then management by a gynecologist is suggested. Sometimes, larger cysts may be incompletely evaluated by transvaginal US, and in these cases, it is important to perform a transabdominal examination. Due to the rare occurrence of malignancy in the simple cyst of the postmenopausal simple ultrasound, no further treatment in cysts up to 3 cm. For cysts greater than 3 cm but less than 10 cm, at least a 1-year follow-up showing stability or decrease in size is recommended with consideration of follow-up for up to 5 years, if stable. If the cyst enlarges, then management by a gynecologist is recommended **(16).**

Hemorrhagic cysts.

Typical hemorrhagic cysts less than or equal to 5 cm in the premenopausal age group do not require further treatment. When greater than 5 cm and less than 10 cm, follow-up 8-12 weeks. If the cyst persists or enlarges, then referral for additional expertise to a US specialist or gynecologist. Hemorrhagic cysts should not occur in the postmenopausal population. Thus, when typical hemorrhagic cysts in the postmenopausal age group are encountered, less than 10 cm in size, a further evaluation by a US specialist, referral to a gynecologist, or performance of an MRI study is suggested.

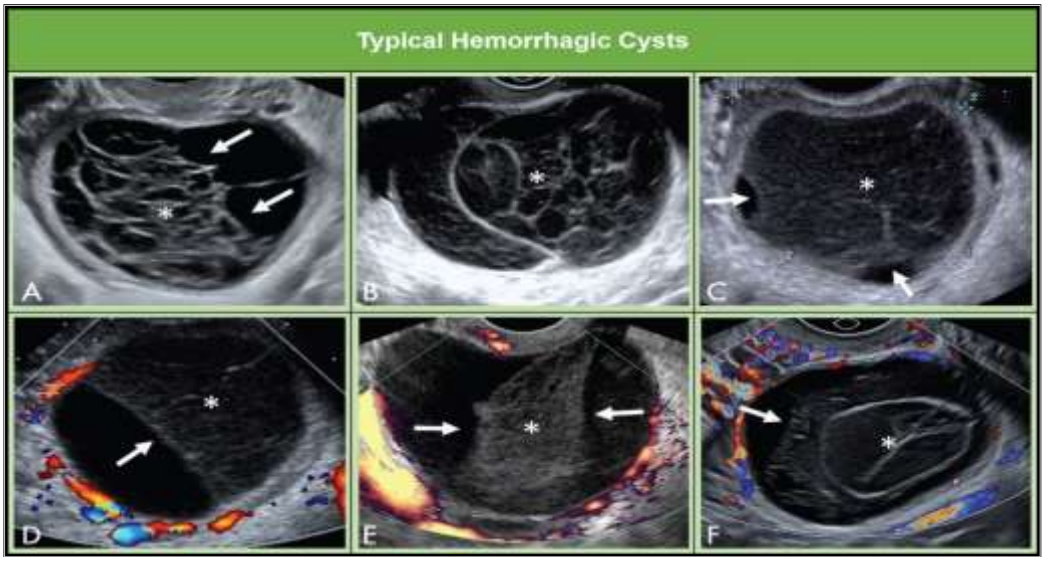


Fig. (16): Images show typical hemorrhagic cysts **(10).**

Dermoid cysts and endometriomas.

Typical dermoid cysts and endometriomas that are less than 10 cm are treated in a similar way. In the premenopausal patient, an optional initial follow-up at 8–12 weeks may be helpful based on confidence in the diagnosis. These patients are usually under the care of a gynecologist. In the postmenopausal group, patients with a confident diagnosis of a dermoid cyst or endometrioma may be considered for follow-up in the US when not surgically excised. In postmenopausal patients, the risk of malignancy and the risk of malignant transformation are greater in endometriomas, so this risk should be considered. If there is a change in morphology or a developing vascular component within the lesion, then referral to a US specialist in the premenopausal age group and direct referral to magnetic resonance imaging is recommended in the postmenopausal group **(16).**

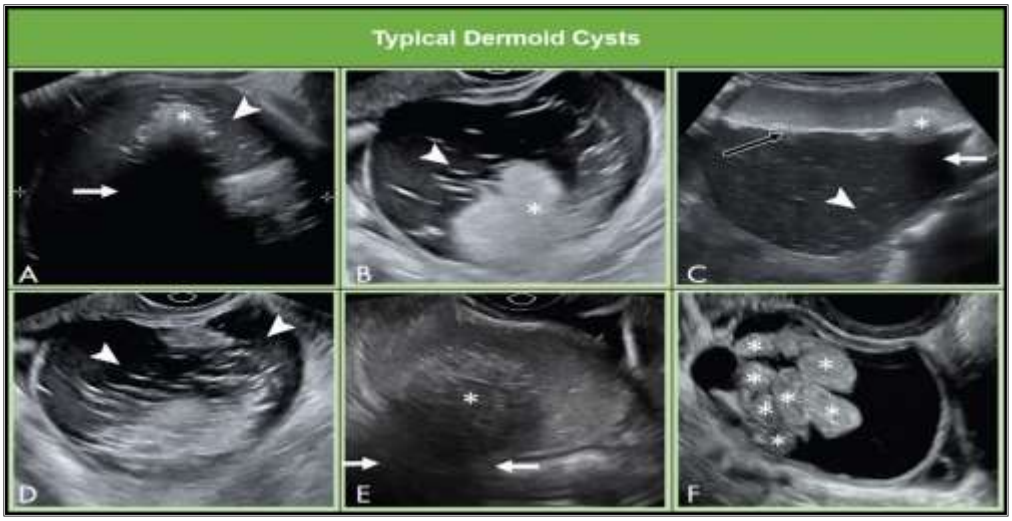


Fig. (17): Images show typical dermoid cysts **(10).**

Extraovarian cysts.

These include the typical peritoneal inclusion cysts, Para ovarian cysts and the typical hydro salpinges of any size. Generally, no further follow-up is needed for simple Para ovarian cysts with an optional follow-up at 1 year in the postmenopausal age group. If it is not simple, the cyst should be managed according to O-RADS US criteria. Management by a gynecologist is necessary for typical cysts of cysts of cysts of cysts of cysts of cysts of cysts of cysts of peritoneal inclusion or hydro salpinges.

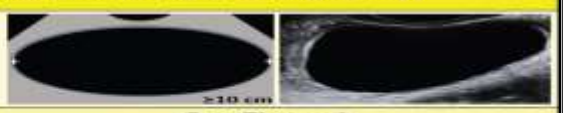
Nonsimple Unilocular Smooth Cysts

Unilocular cysts when less than or equal to 3 cm, and with smooth inner margins that are not simple and do not fall into any of the categories of classic benign lesions, do not, do not, do not, do not require treatment in the premenopausal age group. A follow-up US up to 8–12 weeks, in the proliferative phase, if possible, is necessary for cysts greater than 3 cm and less than 10 cm. In the postmenopausal age group, follow-up in 1 year if the cyst is less than or equal to 3 cm. Treatment by a gynecologist is recommended for larger premenopausal cysts that are larger than 3 cm and for for all nonsimple nonsimple postmenopausal unilocular smooth cysts.

O-RADS 3 (1% to 10% Risk of Malignancy)

The majority of O-RADS 3 lesions (90%) are benign and there is no need for consultation with a gynecologic oncologist. Patients with this group of lesions must be managed by a general gynecologist. Therefore, consultation with a US specialist to minimize the risk of overlooking more suspicious features is encouraged by the O-RADS US management scheme.

Table (4): Ovarian-Adnexal Reporting and Data System (O-RADS) US category 3, low risk of malignancy **(10).**

O-RADS 3 – Low Risk (1 - < 10% likelihood of malignancy)	
Unilocular cyst*, ≥ 10 cm *Simple or non-simple	
Typical hemorrhagic cyst, dermoid cyst, endometrioma, ≥ 10 cm	See Figure 9: "O-RADS 2 - Classic Benign Lesions and Associated Descriptors"
Unilocular cyst with irregular inner wall*, any size *< 3 mm height	
Multilocular cyst with smooth inner wall, < 10 cm, color score 1-3* *Color score 1-3: No to moderate flow	
Solid or solid-appearing (≥ 80%) with smooth contour, any size, color score 1* *Color score 1: No flow	

O-RADS 4 (10% to 50% Risk of Malignancy)

In category 4, US findings warrant consultation with gynecologic oncology prior to removal or referral for management **(17).** In menopausal conditions, US specialist evaluation and serum biomarkers (most commonly CA-125) play a role in deciding which of these lesions must be referred for treatment by a gynecologic oncologist **(10).**

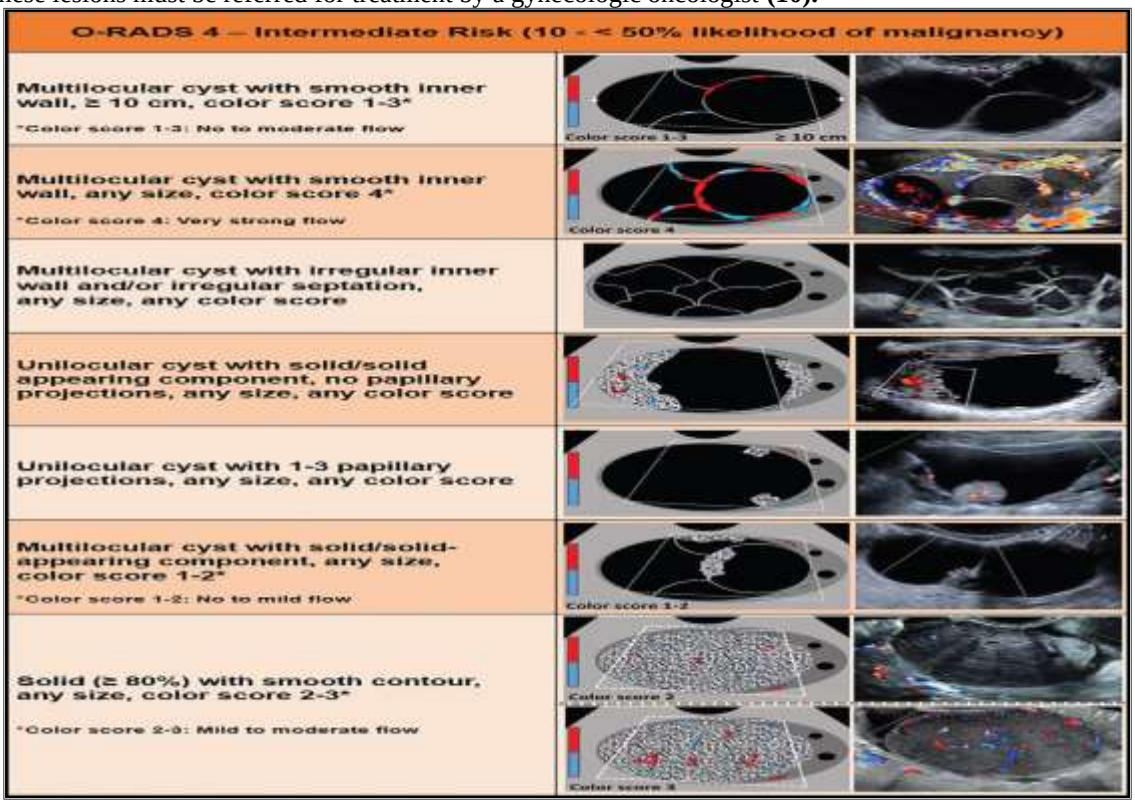
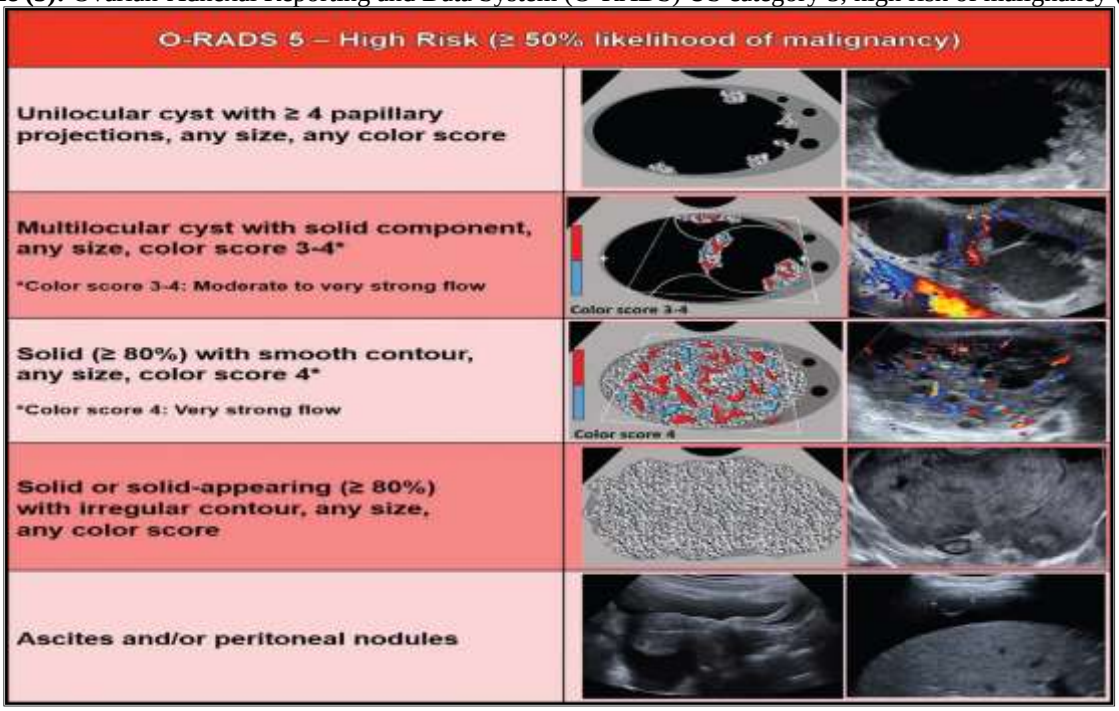


Fig. (18): Ovarian-Adnexal Reporting and Data System (O-RADS) US category 4, intermediate risk of malignancy **(10).**

O-RADS 5 (50% to 100% Risk of Malignancy)

The system recorded that category 5 US findings (high-risk lesions) must be directly referred to a gynecologic oncologist for management. Although serum markers do play a role in evaluation **(17).**

Table (5): Ovarian-Adnexal Reporting and Data System (O-RADS) US category 5, high risk of malignancy **(10).**



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