

**American College of Radiology  
ACR Appropriateness Criteria®  
Clinically Suspected Adnexal Mass, No Acute Symptoms**

**Variant 1:** Adult patient assigned female at birth. Clinically suspected adnexal mass, no acute symptoms. Premenopausal or postmenopausal. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transabdominal	Usually Appropriate	○
US pelvis transabdominal and US pelvis transvaginal	Usually Appropriate	○
US pelvis transvaginal	Usually Appropriate	○
MRI pelvis without and with IV contrast	May Be Appropriate	○
MRI pelvis without IV contrast	May Be Appropriate	○
CT pelvis with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without and with IV contrast	Usually Not Appropriate	⊕⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

**Variant 2:** Adult patient assigned female at birth. Adnexal mass, likely benign, no acute symptoms. Premenopausal. Follow-up imaging.

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transabdominal	Usually Appropriate	○
US pelvis transabdominal and US pelvis transvaginal	Usually Appropriate	○
US pelvis transvaginal	Usually Appropriate	○
MRI pelvis without and with IV contrast	May Be Appropriate	○
MRI pelvis without IV contrast	May Be Appropriate	○
CT pelvis with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without and with IV contrast	Usually Not Appropriate	⊕⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

**Variant 3:**                    **Adult patient assigned female at birth. Adnexal mass, likely benign, no acute symptoms. Postmenopausal. Follow-up imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transabdominal	Usually Appropriate	○
US pelvis transabdominal and US pelvis transvaginal	Usually Appropriate	○
US pelvis transvaginal	Usually Appropriate	○
MRI pelvis without and with IV contrast	May Be Appropriate	○
MRI pelvis without IV contrast	May Be Appropriate	○
CT pelvis with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without and with IV contrast	Usually Not Appropriate	⊕⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

**Variant 4:**                    **Adult patient assigned female at birth. Adnexal mass, indeterminate on initial pelvic US, no acute symptoms. Premenopausal or postmenopausal. Next imaging study for characterization.**

Procedure	Appropriateness Category	Relative Radiation Level
MRI pelvis without and with IV contrast	Usually Appropriate	○
MRI pelvis without IV contrast	May Be Appropriate	○
CT pelvis with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without and with IV contrast	Usually Not Appropriate	⊕⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

**Variant 5:**                    **Adult patient assigned female at birth. Adnexal mass, indeterminate on initial pelvic US, no acute symptoms. Premenopausal. Follow-up imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transabdominal and US pelvis transvaginal	Usually Appropriate	○
US pelvis transvaginal	Usually Appropriate	○
MRI pelvis without and with IV contrast	Usually Appropriate	○
US pelvis transabdominal	May Be Appropriate	○
MRI pelvis without IV contrast	May Be Appropriate	○
CT pelvis with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without and with IV contrast	Usually Not Appropriate	⊕⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

**Variant 6:****Adult patient assigned female at birth. Adnexal mass, indeterminate on initial pelvic US, no acute symptoms. Postmenopausal. Follow-up imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transabdominal	Usually Appropriate	○
US pelvis transabdominal and US pelvis transvaginal	Usually Appropriate	○
US pelvis transvaginal	Usually Appropriate	○
MRI pelvis without and with IV contrast	Usually Appropriate	○
MRI pelvis without IV contrast	May Be Appropriate	○
CT pelvis with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without and with IV contrast	Usually Not Appropriate	⊕⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

**Variant 7:****Adult patient assigned female at birth. Adnexal mass, highly suspicious for malignancy on pelvic US, no acute symptoms. Premenopausal or postmenopausal. Next imaging study for characterization.**

Procedure	Appropriateness Category	Relative Radiation Level
MRI pelvis without and with IV contrast	Usually Appropriate	○
MRI pelvis without IV contrast	May Be Appropriate	○
CT pelvis without and with IV contrast	May Be Appropriate (Disagreement)	⊕⊕⊕⊕
CT pelvis with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without IV contrast	Usually Not Appropriate	⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

**Variant 8:****Clinically suspected adnexal mass, no acute symptoms. Pregnant. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transabdominal	Usually Appropriate	○
US pelvis transabdominal and US pelvis transvaginal	Usually Appropriate	○
US pelvis transvaginal	Usually Appropriate	○
MRI pelvis without IV contrast	May Be Appropriate	○
MRI pelvis without and with IV contrast	Usually Not Appropriate	○
CT pelvis with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without IV contrast	Usually Not Appropriate	⊕⊕⊕
CT pelvis without and with IV contrast	Usually Not Appropriate	⊕⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

**Variant 9:****Adult patient assigned female at birth. Adnexal mass, indeterminate on initial pelvic US, no acute symptoms. Pregnant. Next imaging study for characterization.**

Procedure	Appropriateness Category	Relative Radiation Level
MRI pelvis without IV contrast	Usually Appropriate	○
MRI pelvis without and with IV contrast	Usually Not Appropriate	○
CT pelvis with IV contrast	Usually Not Appropriate	☢☢☢
CT pelvis without IV contrast	Usually Not Appropriate	☢☢☢
CT pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢☢

## CLINICALLY SUSPECTED ADNEXAL MASS, NO ACUTE SYMPTOMS

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### **Summary of Literature Review**

#### **Introduction/Background**

Ovarian cancer is the fifth leading cause of cancer mortality among women in the United States, showing little improvement in survival over the last several decades [1,2]. In 2023, it is estimated that 19,710 women will be diagnosed with ovarian cancer in the United States, and 13,270 will die from their disease [3]. Prognostic factors associated with survival include both stage at diagnosis and treatment at a high-volume center with management by a gynecologist oncologist [4,5]. High-grade serous carcinoma, now thought to arise typically from fallopian tube epithelium, is most often diagnosed at late stage and accounts for nearly 80% of ovarian cancer deaths [1,6].

Identification of early-stage cancers is paramount for cancer-specific survival in ovarian cancer, but only 16% of patients are diagnosed at early stages. Although the 5-year relative survival for ovarian cancer is 49.1%, it increases to nearly 93% for stage I disease (confined to the ovaries/adnexa) [3].

Fortunately, the vast majority of adnexal masses are benign, representing physiologic cysts, hemorrhagic cysts, dermoids, endometriomas, hydrosalpinx, fibroma, or pedunculated fibroids [7]. Many lesions can be followed expectantly or, if meeting treatment criteria due to symptoms, undergo surgical intervention via minimally invasive techniques. Imaging may be used to characterize adnexal lesions, avoiding unnecessary treatment for benign lesions, while identifying the subset with some degree of risk for malignancy that require gynecologic oncology referral or follow-up imaging. Nearly 9.1 surgeries are performed every year for every 1 malignancy in the United States [8]. Operating on benign lesions comes with economic cost and is not without risk to the patient; the perioperative mortality rate is approximately 0.05% for an adnexal mass, and reported rates of major complication range from 3% to 15% in screening trials [2,9]. This document addresses both cisgender females (birth assigned female with female gender identity) and transgender and gender diverse individuals assigned female at birth.

For more information on the staging and follow-up of ovarian cancer, please see the ACR Appropriateness Criteria<sup>®</sup> topic on “[Staging and Follow-up of Ovarian Cancer](#)” [10].

#### **Special Imaging Considerations**

*Contrast-enhanced ultrasound:* Contrast-enhanced ultrasound (CEUS) can be a useful real-time technique to demonstrate the presence of internal vascular soft tissue component in an indeterminate ovarian lesion that increases the risk of malignancy. Soft tissue enhancing earlier than or concurrent to the myometrium was found in 93.8% of malignant lesions in 1 study compared with 12.5% of benign lesions [11]. The International Ovarian Tumor Analysis (IOTA) simple rules performed well when applied to CEUS in 1 study, with reduction in indeterminate masses from 36.7% to 11.7% when using CEUS after conventional pelvic ultrasound (US) in a surgical cohort of suspected malignant masses [12]. Three-dimensional CEUS and 3-D contrast-enhanced power Doppler may be useful as adjunct to conventional US and 2-D CEUS [13,14]. In a meta-analysis, CEUS had higher accuracy for differentiating benign and malignant lesions than conventional US (94% versus 83%); however, further evaluation of the clinical use of CEUS is needed [15].

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## Initial Imaging Definition

Initial imaging is defined as imaging at the beginning of the care episode for the medical condition defined by the variant. More than one procedure can be considered usually appropriate in the initial imaging evaluation when:

- There are procedures that are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care)

OR

- There are complementary procedures (ie, more than one procedure is ordered as a set or simultaneously where each procedure provides unique clinical information to effectively manage the patient's care).

## Discussion of Procedures by Variant

**Variant 1: Adult patient assigned female at birth. Clinically suspected adnexal mass, no acute symptoms. Premenopausal or postmenopausal. Initial imaging.**

### CT Pelvis With IV Contrast

CT pelvis with intravenous (IV) contrast is typically not useful for the initial workup and characterization of adnexal masses due to suboptimal delineation of soft tissue in the adnexal region. The presence of macroscopic fat, with or without the presence of calcification and/or Rokitansky nodule, is diagnostic of a dermoid if seen on CT.

### CT Pelvis Without and With IV Contrast

CT pelvis without and with IV contrast is typically not useful for the initial workup and characterization of adnexal masses due to suboptimal delineation of soft tissue in the adnexal region. The presence of macroscopic fat, with or without the presence of calcification and/or Rokitansky nodule, is diagnostic of a dermoid if seen on CT.

### CT Pelvis Without IV Contrast

CT pelvis without IV contrast is typically not useful for the initial workup and characterization of adnexal masses due to suboptimal delineation of soft tissue in the adnexal region. The presence of macroscopic fat, with or without the presence of calcification and/or Rokitansky nodule, is diagnostic of a dermoid if seen on CT.

### FDG-PET/CT Skull Base to Mid-Thigh

Fluorine-18-2-fluoro-2-deoxy-D-glucose (FDG)-PET/CT is not useful for the initial workup and characterization of adnexal masses due to suboptimal delineation of soft tissue in the adnexal region.

### MRI Pelvis Without and With IV Contrast

MRI can accurately diagnose the presence of adnexal lesions and identify enhancing soft tissue as well as other distinguishing characteristics such as the type of fluid content, presence of fat, or presence of septations in a cystic lesion. It performs superior to US; however, it is not the first-line modality for initial evaluation [16,17]. If a patient with a suspected adnexal lesion is unable to be evaluated via US (due to large size of lesion >10 cm, poor acoustic window from adjacent viscera or body habitus, or unclear organ of origin), MRI would be the best alternative imaging modality for evaluation.

### MRI Pelvis Without IV Contrast

If MRI is being used for evaluation of a suspected adnexal lesion, IV contrast is recommended to evaluate for any internal enhancing component.

Contrast-enhanced MRI performs superiorly to both US and noncontrast MRI due to its ability to confirm the presence of internal enhancing soft tissue components [18]. A recent study evaluating the usefulness of noncontrast MRI in 350 lesions in a population with 15% malignancies demonstrated a sensitivity of 85%, specificity of 96%, and accuracy of 94.2% to detect cancer [19]. Noncontrast MRI may be used in adnexal mass characterization when the use of IV contrast is precluded.

### US Duplex Doppler Pelvis

Although considered a separate examination in the ACR documentation, color and power Doppler evaluation is considered an integral part of the complete transabdominal and transvaginal sonographic assessment of an adnexal lesion. Doppler can help identify internal soft tissue with vascular flow within a suspected adnexal lesion that can help differentiate a malignancy from a solid-appearing component such as a clot or debris [20-22]. Optimal sonographic evaluation is achieved by using a combination of grayscale morphologic assessment and color or power Doppler imaging to detect flow within any solid areas. Color Doppler characteristics, namely a color score of 1 to

4 (ranging from no flow to very strong flow), and binary system of no flow versus very strong flow are used in the Ovarian-Adnexal Reporting and Data System (O-RADS) and IOTA simple rules classification systems, respectively [23,24]. Additionally, color Doppler evaluation can help to confirm the origin of a mass from the uterus rather than the ovary with the presence of a “bridging vessel sign” [25]. No specific spectral Doppler parameters (resistive index, pulsatility index, peak systolic velocity time, time averaged  $SUV_{max}$ ) are currently used in clinical practice due to overlapping features of benign versus malignant lesions; however, spectral evaluation may be useful in distinguishing motion-related changes on color or power Doppler from true flow [20,21,26].

### **US Pelvis Transabdominal**

Transabdominal US may be performed without transvaginal imaging when the transvaginal examination cannot be tolerated. A full bladder provides a better acoustic window for the evaluation of pelvis/adnexa.

### **US Pelvis Transabdominal and US Pelvis Transvaginal**

Transvaginal US is the most useful initial imaging modality in the assessment of adnexal pathology with a sensitivity >90%, and diagnostic performance is likely improved when undertaken by experienced operators [27,28]. It is widely accepted clinically as the initial imaging modality of choice [29-31].

Initial evaluation by transabdominal and transvaginal US can often definitively characterize ovarian lesions, specifically those that demonstrate classically benign US features (eg, follicles, functional cysts, hemorrhagic cysts, dermoids, and endometriomas). Lesions that demonstrate solid components such as irregular thick septations, papillary projections, or mural nodules have variable risk of malignancy. Various US and combined US/clinical based criteria have been proposed for standardized interpretation and characterization of adnexal masses to improve risk-stratified management of these lesions [23,24,32-37]. These include the IOTA simple rules, O-RADS, Society of Radiologists in Ultrasound (SRU) consensus statement for incidental adnexal masses, and Assessment of Different Neoplasias in the adnexa (ADNEX) model. These are beyond the scope of discussion for this document, and the readers are directed to the respective literature for details [23,24,34,37-41]. These systems use some combination of classically benign imaging features, lesion size, locularity, size and number of solid components, and degree of vascularity for categorization and determining overall risk of malignancy.

The SRU consensus statement [42] has been shown to decrease unnecessary follow-up care of benign adnexal lesions, correlate with the risk of malignancy in symptomatic women, and demonstrate high sensitivity and specificity for detecting ovarian malignancy [43-45].

O-RADS [23,38] has demonstrated significantly higher sensitivity for malignancy than the IOTA simple rules (96.8% versus 92.1%) and no significant difference in specificity (92.8% versus 93.2%) [46].

Combined transvaginal and transabdominal technique allows for the identification of pertinent features relevant for characterization and categorization of these lesions. The transvaginal component allows for detailed evaluation with the transabdominal component helpful for larger lesions that may be suboptimally seen transvaginally.

### **US Pelvis Transvaginal**

The most useful modality for evaluation of adnexal masses includes transvaginal US combined with a transabdominal US approach.

**Variant 2: Adult patient assigned female at birth. Adnexal mass, likely benign, no acute symptoms. Premenopausal. Follow-up imaging.**

#### **CT Pelvis With IV Contrast**

CT pelvis with IV contrast is usually not useful to follow likely or known benign adnexal masses. Because the roles of US and MRI are well established, there is little reason presently to obtain a CT for benign mass follow-up.

#### **CT Pelvis Without and With IV Contrast**

CT pelvis without and with IV contrast is usually not useful to follow likely or known benign adnexal masses. Because the roles of US and MRI are well established, there is little reason presently to obtain a CT for benign mass follow-up.

#### **CT Pelvis Without IV Contrast**

CT pelvis without IV contrast is usually not useful to follow likely or known benign adnexal masses. Because the roles of US and MRI are well established, there is little reason presently to obtain a CT for benign mass follow-up.

### **FDG-PET/CT Skull Base to Mid-Thigh**

There is no role for the use of FDG-PET/CT in the follow-up of benign adnexal masses in premenopausal patients.

### **MRI Pelvis Without and With IV Contrast**

Although MRI can accurately characterize these benign lesions, it is not the first-line modality [16,17]. If a known lesion requiring surveillance is unable to be followed via US, MRI would be the alternative imaging modality of choice for follow-up.

Classically benign lesions such as simple cysts, endometriomas and dermoid, and extraovarian benign lesions have characteristic appearances on MRI and can be confidently diagnosed as almost certainly benign [17].

### **MRI Pelvis Without IV Contrast**

If MRI is being used for follow-up of a benign lesion, IV contrast is recommended to evaluate for any developing enhancing component.

Contrast-enhanced MRI performs superiorly to both US and noncontrast MRI due to its ability to confirm the presence of internal enhancing soft tissue components [18]. A recent study evaluating the usefulness of noncontrast MRI in 350 lesions in a population with 15% malignancies and demonstrated a sensitivity of 85%, specificity of 96%, and accuracy of 94.2% to detect cancer [19]. Noncontrast MRI may be used in adnexal mass characterization when the use of IV contrast is precluded.

### **US Duplex Doppler Pelvis**

Color or power Doppler should be included in the US examination of the pelvis. Color Duplex is used to evaluate vascularity of any developing solid component.

### **US Pelvis Transabdominal**

Transabdominal US may be performed without transvaginal imaging when the transvaginal examination cannot be tolerated. The bladder should be full to provide the best acoustic window for evaluation.

### **US Pelvis Transabdominal and US Pelvis Transvaginal**

US can accurately diagnose benign adnexal lesions including simple cysts, hemorrhagic cysts, endometriomas, and dermoids as well as extraovarian cystic lesions such as parovarian cysts, hydrosalpinx, and peritoneal inclusion cysts. Adnexal lesions that can be adequately assessed and characterized on US may be followed-up with US.

The vast majority of simple cysts in premenopausal patients are functional cysts, which will wax and wane over time or resolve, with a small portion reflecting benign neoplasms. A large body of evidence including several large recent studies has shown that simple cysts, regardless of size and menopausal status, are not associated with an increased risk of cancer [35,47-49]. Invasive serous cystadenocarcinoma is now thought to primarily originate from solid precursors in the fallopian tube and serous tubal intraepithelial carcinoma, further supporting the benignity of simple ovarian cysts [50]. A recent consensus update to the SRU in 2019 regarding management of simple cysts reflects these findings with higher threshold for follow-up of simple cysts [42]. Namely, in premenopausal women, simple cysts, including paraovarian and paratubal cysts <5 cm, do not need to be followed. The rationale of follow-up for simple cysts >5 cm (and 7 cm for exceptionally well seen cysts) is based on a potential risk of mischaracterization of larger cysts and potential clinical value of size monitoring growth rates of larger cysts, which may reflect benign neoplasms and warrant clinical follow-up along with a very small predisposition for torsion or rupture [51].

Classic benign lesions include endometriomas, hemorrhagic cysts, and dermoids as well as benign extraovarian lesions such as paraovarian cysts, hydrosalpinx, and peritoneal inclusion cysts have characteristic appearances on US [23,34]. Hemorrhagic functional cysts will decrease or resolve on sonographic follow-up in 8 to 12 weeks versus nonfunctional cysts, which will persist. Endometriomas may change in appearance with age, losing the classic unilocular ground glass appearance with multilocular appearance and presence of nonvascular papillary or other solid components more common in older premenopausal women [52]. These changes can overlap with malignancy and endometriomas and require yearly follow-up due to a small risk of malignant transformation [53]. Sonographically diagnosed dermoids, if not excised, can be safely followed with yearly US with the risk of missing malignant degeneration quite low [54].

A recent study by Gupta et al [55] demonstrated that the risk of malignancy in these classic “benign”-appearing lesions is <1% in a cohort of 970 average-risk women. Risk of malignancy in benign-appearing lesions on US



managed conservatively with 2-year follow-up was 0.3% to 0.4% for malignancy and 0.2% to 0.4% for acute complications such as torsion or cyst rupture [51].

Unilocular cysts, as a whole, in the premenopausal population similarly have a very low risk of malignancy. A recent meta-analysis by Parazzini et al [56] demonstrated that in 987 unilocular cysts removed surgically in premenopausal women, the risk of malignancy was 0.6%. Similar findings were found by Valentin et al [57], with a rate of malignancy of 0.5% in 981 surgically resected lesions. Surgical cohorts have a bias of increased risk of malignancy due to persistent cysts, and thus, this can be extrapolated into an even lower theoretical risk of malignancy in the general population.

The most common benign solid adnexal mass is the uterine fibroid. Pedunculated lesions or broad ligament fibroids can often be mistaken for solid adnexal mass. Fibroids are present in up to 20% to 30% of reproductive age women, and the presence of bridging vessels can help identify uterine origin along with careful search for the ovaries [25].

### **US Pelvis Transvaginal**

The most useful modality for evaluation of adnexal masses includes transvaginal US combined with transabdominal US approach.

**Variant 3: Adult patient assigned female at birth. Adnexal mass, likely benign, no acute symptoms. Postmenopausal. Follow-up imaging.**

### **CT Pelvis With IV Contrast**

CT pelvis with IV contrast is usually not useful to follow likely or known benign adnexal masses. Because the roles of US and MRI are well established, there is little reason presently to obtain a CT for benign mass follow-up.

### **CT Pelvis Without and With IV Contrast**

CT pelvis without and with IV contrast is usually not useful to follow likely or known benign adnexal masses. Because the roles of US and MRI are well established, there is little reason presently to obtain a CT for benign mass follow-up.

### **CT Pelvis Without IV Contrast**

CT pelvis without IV contrast is usually not useful to follow likely or known benign adnexal masses. Because the roles of US and MRI are well established, there is little reason presently to obtain a CT for benign mass follow-up.

### **FDG-PET/CT Skull Base to Mid-Thigh**

There is no role for the use of FDG-PET/CT in the follow-up of benign adnexal masses in postmenopausal patients.

### **MRI Pelvis Without and With IV Contrast**

Although MRI can accurately characterize these benign lesions, it is not the first-line imaging modality [16,17]. If a known lesion requiring surveillance is unable to be followed via US, MRI would be the alternative imaging modality of choice for follow-up. Classical benign lesions such as simple cysts, endometriomas and dermoid, and extraovarian benign lesions have characteristic appearances on MRI and can be confidently diagnosed as almost certainly benign [17].

### **MRI Pelvis Without IV Contrast**

If MRI is being used for follow-up of a benign lesion, IV contrast is recommended to evaluate for any developing enhancing component.

Contrast-enhanced MRI performs superiorly to both US and noncontrast MRI due to its ability to confirm the presence of internal enhancing soft tissue components [18]. A recent study evaluating the usefulness of noncontrast MRI in 350 lesions in a population with 15% malignancies demonstrated a sensitivity of 85%, specificity of 96%, and accuracy of 94.2% to detect cancer [19]. Noncontrast MRI may be used in adnexal mass characterization when the use of IV contrast is precluded.

### **US Duplex Doppler Pelvis**

Color or power Doppler should be included in the US examination of the pelvis. Color Duplex is used to evaluate vascularity of any developing solid component.

### **US Pelvis Transabdominal**

Transabdominal US may be performed without transvaginal imaging when the transvaginal examination cannot be tolerated. The bladder should be full to provide the best acoustic window for evaluation.

## **US Pelvis Transabdominal and US Pelvis Transvaginal**

Likely benign adnexal lesions that can be adequately assessed and characterized on US may be followed sonographically.

A large body of evidence including several large recent screening studies has shown that unilocular simple cysts, regardless of size and menopausal status, are not associated with an increased risk of cancer [35,47-49]. In a large series, approximately 13% to 14% of women over 50 to 55 years of age, respectively, had simple ovarian cysts, with 8% demonstrating new cysts and 32% with no cyst at 1-year follow-up, with a near nonexistent risk of malignancy [47]. A second recent study of 72,093 women, those with simple cysts, demonstrated an absolute 3-year risk of ovarian cancer, 0 to 0.5 cases per 10,000 women, not dissimilar to women with normal ovaries [47,49]. Invasive serous cystadenocarcinoma is now primarily thought to originate from solid precursors in the fallopian tube, serous tubal intraepithelial carcinoma, further supporting the benignity of simple ovarian cysts [50]. A recent consensus update to the SRU in 2019 regarding management of simple cysts reflects these findings with higher threshold for follow-up of simple cysts [42]. For postmenopausal patients, the SRU endorses follow-up of simple cysts >3 cm (and 5 cm for those that are exceptionally well seen) rather than the previous 1-cm threshold [42,58]. The rationale of follow-up for simple cysts is based on a potential risk of mischaracterization of larger cysts and potential clinical value of size monitoring growth rates of larger cysts, which may reflect benign neoplasms and warrant clinical follow-up.

Unilocular cysts, as a whole, in the postmenopausal population similarly have a very low risk of malignancy. In a surgical cohort of 3,511 masses, 217 of which were unilocular cysts in postmenopausal women, the rate of malignancy was 3%, with hemorrhagic contents more common in malignant unilocular lesions [57]. In a second study of 15,106 women with 3,259 unilocular cystic lesions, there were 10 cancers detected over a 6.3-year period, none of which developed from the isolated cystic lesion [59]. A more recent meta-analysis demonstrated that of 372 unilocular cysts removed surgically in postmenopausal women, the risk of malignancy was 3.2% [56].

Endometriomas in postmenopausal women are uncommon and less often demonstrate the “classic” features of endometriomas; rather, they are often multilocular with mixed echogenicity fluid and are at an increased risk of malignant transformation, clear cell, or endometrioid carcinomas [60]. Additional benign lesions such as dermoids, and extraovarian cystic lesions (parovarian cysts, hydrosalpinx, and peritoneal inclusion cysts), if seen well, may be followed sonographically.

## **US Pelvis Transvaginal**

The most useful modality for evaluation of adnexal masses includes transvaginal US combined with transabdominal US approach.

### **Variant 4: Adult patient assigned female at birth. Adnexal mass, indeterminate on initial pelvic US, no acute symptoms. Premenopausal or postmenopausal. Next imaging study for characterization.**

Up to 22% to 24% of adnexal masses remain indeterminate after US evaluation [61,62]. No single definition exists for these indeterminate lesions. Some examples include multilocular cysts, or lesions with avascular or low level vascular internal solid components. In a multicenter prospective study of 303 indeterminate adnexal cysts, the incidence of malignancy was 3.6% [61]. In a second multicenter prospective study of 697 women, the prevalence of malignancy in indeterminate lesions ranged from 4.8% to 10.7% using SRU guidelines and IOTA simple rules, respectively [45]. Lesions that are not classically benign appearing have a risk of malignancy ranging from 8% to 50% [55].

## **CT Pelvis With IV Contrast**

CT pelvis with IV contrast is usually not useful in further characterization of indeterminate adnexal masses. Because the role of MRI is well established, there is little reason presently to obtain a CT for further characterization of an indeterminate lesion.

## **CT Pelvis Without and With IV Contrast**

CT pelvis without and with IV contrast is usually not useful in further characterization of indeterminate adnexal masses. Because the role of MRI is well established, there is little reason presently to obtain a CT for further characterization of an indeterminate lesion.

### **CT Pelvis Without IV Contrast**

CT pelvis without IV contrast is usually not useful in further characterization of indeterminate adnexal masses. Because the role of MRI is well established, there is little reason presently to obtain a CT for further characterization of an indeterminate lesion.

### **FDG-PET/CT Skull Base to Mid-Thigh**

PET/CT cannot reliably differentiate between benign and malignant adnexal lesions [63]. In premenopausal women, normal ovaries with late follicular or early luteal cysts can have mildly increased uptake [64]. Although maximum standardized uptake value ( $SUV_{max}$ ) are higher in malignant tumors and low in benign lesions, there is no clear  $SUV_{max}$  cutoff value to differentiate the two [65]. Additionally, PET/CT cannot reliably differentiate between borderline tumors and benign lesions and has low uptake on clear cell and mucinous invasive adenocarcinoma subtypes [66,67]. Although PET-avid lesions in postmenopausal women are concerning for malignancy, its use to detect primary cancer is not recommended [68].

### **MRI Pelvis Without and With IV Contrast**

MRI is the most useful modality for further evaluation of the subset of lesions that remain indeterminate after sonographic evaluation [69]. A recent study assessing the SRU guidelines ability to risk stratify lesions demonstrated potential of MRI to decrease surgical evaluation for benign cysts by 89% [44]. MRI has an excellent accuracy of >90% for the diagnosis of malignancy [69-71]. MRI can accurately identify solid tissue from nonsolid tissue such as fat, blood, or debris that may appear solid on initial US [72]. MRI can also help determine the origin of the lesion, with up to 9% of presumed adnexal lesions on US being nonadnexal origin [73]. Sonographically visualized lesions >10 cm may need contrast-enhanced MRI to ensure complete visualization and assessment of the lesion and ensure there are no associated solid components.

The presence or absence of enhancing solid tissue and enhancement curve characteristics as evaluated on perfusion dynamic contrast-enhanced imaging drives the risk of malignancy on MRI [17,69,71,74-80]. The absence of enhancement renders the risk of malignancy to nearly 0%, which is of particular value in the sonographically indeterminate lesions because it confirms the benignity of the lesion [71]. Solid tissue with time intensity curves (TIC) with rapid enhancement greater than the myometrium (type 3) are only found in invasive malignant tumors with a sensitivity of 67% versus slow low level enhancement (type 1) found in benign tumors with a sensitivity of 70% and specificity of 89% [79].

Diffusion-weighted imaging (DWI) and apparent diffusion coefficient (ADC) values of benign and malignant lesions overlap, with Fujii et al [81] demonstrating teratomas, some endometriomas, and malignant tumors demonstrating abnormal DWI signal. The primary value of DWI is in the setting of a low T2 signal mass, with low signal on DWI predicting a high likelihood of benignity [69,81,82].

Similar to US, evidence-based classification systems based on the above MR features have been proposed for standardized interpretation and characterization of adnexal lesions to improve risk-stratified management. These include the ADNEX MR system and its evolving adaptation, the O-RADS MRI reporting system. The details of these are beyond the scope of discussion for this document, and the readers are directed to the respective literature for details [17,71,73,83]. The ADNEX MR system has shown an overall accuracy of 96% for indeterminate adnexal lesion characterization and a sensitivity of 93.5% and specificity of 96.6% for score  $\geq 4$ , with good reproducibility and external validation [84-86]. The O-RADS MR reporting system yields overall accuracy of 92%, with a sensitivity of 93%, specificity of 91%, positive predictive value (PPV) of 71%, and negative predictive value of 98% [17,71,73,83].

### **MRI Pelvis Without IV Contrast**

Contrast-enhanced MRI performs superiorly to both US and noncontrast MRI due to its ability to confirm the presence of internal enhancing soft tissue components [18]. Both the ADNEX and O-RADS MRI risk stratification systems will have some decreased usefulness in the noncontrast setting given the limited ability to identify enhancing solid tissue and its enhancement pattern, both crucial for characterizing indeterminate lesions [17,71,73]. For example, the overall specificity for malignancy of the ADNEX MR system falls below 90% if used without dynamic contrast enhancement [71,87]. Sahin et al [19] proposed a noncontrast MRI score based on ADNEX and O-RADS models using morphologic assessment and DWI with an 84.9% sensitivity, 95.9% specificity, and 94% accuracy with the caveat of a population with a lower malignancy rate (15.1%) than the original ADNEX and O-RADS models population (18.8% and 18.4%). Noncontrast MRI may be used in adnexal mass characterization when the use of IV contrast is precluded.

**Variant 5: Adult patient assigned female at birth. Adnexal mass, indeterminate on initial pelvic US, no acute symptoms. Premenopausal. Follow-up imaging.**

#### **CT Pelvis With IV Contrast**

CT pelvis with IV contrast is usually not useful for follow-up of an indeterminate adnexal mass. Because the role of US and MRI is well established, there is little reason presently to obtain a CT for follow-up of an indeterminate lesion.

#### **CT Pelvis Without and With IV Contrast**

CT pelvis without and with IV contrast is usually not useful for follow-up of an indeterminate adnexal mass. Because the role of US and MRI is well established, there is little reason presently to obtain a CT for follow-up of an indeterminate lesion.

#### **CT Pelvis Without IV Contrast**

CT pelvis without IV contrast is usually not useful for follow-up of an indeterminate adnexal mass. Because the role of US and MRI is well established, there is little reason presently to obtain a CT for follow-up of an indeterminate lesion.

#### **FDG-PET/CT Skull Base to Mid-Thigh**

There is no role for the use of FDG-PET/CT in the follow-up of indeterminate adnexal masses in premenopausal patients.

#### **MRI Pelvis Without and With IV Contrast**

An indeterminate mass can be followed by contrast-enhanced MRI. This is helpful if the mass cannot be optimally visualized by US or if the mass shows suspicious change of appearance during US surveillance.

Suspected classic lesions (cysts, endometriomas, dermoid) >10 cm, which are suboptimally seen on US due to size, can be confirmed as almost certainly benign, which may alter further imaging follow-up intervals [17].

#### **MRI Pelvis Without IV Contrast**

Contrast-enhanced MRI performs superiorly to both US and noncontrast MRI due to its ability to confirm the presence of internal enhancing soft tissue components [18]. Both the ADNEX and O-RADS MRI risk stratification systems will have some decreased usefulness in the noncontrast setting given the limited ability to identify enhancing solid tissue and its enhancement pattern, both crucial for characterizing indeterminate lesions [17,71,73]. For example, the overall specificity for malignancy of the ADNEX MR system falls below 90% if used without dynamic contrast enhancement [71,87]. Sahin et al [19] proposed a noncontrast MRI score based on ADNEX and O-RADS models using morphologic assessment and DWI with an 84.9% sensitivity, 95.9% specificity, and 94% accuracy with the caveat of a population with a lower malignancy rate (15.1%) than the original ADNEX and O-RADS models population (18.8% and 18.4%). Noncontrast MRI may be used in adnexal mass characterization when the use of IV contrast is precluded.

#### **US Duplex Doppler Pelvis**

Color or power Doppler should be included in the US examination of the pelvis. Color Duplex is used to evaluate vascularity of any developing solid component.

#### **US Pelvis Transabdominal**

Transabdominal US may be performed without transvaginal imaging when the transvaginal examination cannot be tolerated. The bladder should be full to provide the best acoustic window for evaluation.

#### **US Pelvis Transabdominal and US Pelvis Transvaginal**

Indeterminate lesions are typically benign. In a multicenter prospective study of 303 indeterminate adnexal cysts, the incidence of malignancy was 3.6% [61]. In a second multicenter prospective study of 697 women, the prevalence of malignancy in indeterminate lesions ranged from 4.8% to 10.7% using SRU guidelines and IOTA simple rules, respectively [45].

If an indeterminate mass is identified on initial US, then follow-up may be performed either by serial US or by MRI. For example, the former may be helpful to assess a suspected atypical appearing hemorrhagic cyst that is either resolving or undergoing evolution. A reasonable time frame for US follow-up in this setting would be 8 to 12 weeks (as is performed in typical hemorrhagic cysts of larger size in premenopausal women) to permit time for resolution or confirm persistence of a nonphysiologic cyst [23]. If the lesion persists and is stable in size and appearance, further evaluation with MRI may be appropriate, depending on the clinical context and features present.

MRI may be able to assign a specific benign diagnosis or stratify for risk of malignancy, thus requiring no further US follow-up in the majority of cases [17,73].

If not requiring surgical management, indeterminate lesions that are well seen on US may be followed sonographically.

### **US Pelvis Transvaginal**

The most useful modality for evaluation of adnexal masses includes transvaginal US combined with transabdominal US approach.

**VARIANT 6: Adult patient assigned female at birth. Adnexal mass, indeterminate on initial pelvic US, no acute symptoms. Postmenopausal. Follow-up imaging.**

### **CT Pelvis With IV Contrast**

CT pelvis with IV contrast is usually not useful for follow-up of an indeterminate adnexal mass. Because the role of US and MRI is well established, there is little reason presently to obtain a CT for follow-up of an indeterminate lesion.

### **CT Pelvis Without and With IV Contrast**

CT pelvis without and with IV contrast is usually not useful for follow-up of an indeterminate adnexal mass. Because the role of US and MRI is well established, there is little reason presently to obtain a CT for follow-up of an indeterminate lesion.

### **CT Pelvis Without IV Contrast**

CT pelvis without IV contrast is usually not useful for follow-up of an indeterminate adnexal mass. Because the role of US and MRI is well established, there is little reason presently to obtain a CT for follow-up of an indeterminate lesion.

### **FDG-PET/CT Skull Base to Mid-Thigh**

There is no role for the use of FDG-PET/CT in the follow-up of indeterminate adnexal masses in postmenopausal patients.

### **MRI Pelvis Without and With IV Contrast**

An indeterminate mass can be followed by contrast-enhanced MRI. This is helpful if the mass cannot be optimally visualized by US or if the mass shows suspicious change of appearance during US surveillance.

Suspected ovarian thecoma-fibroma group tumors, typically classified as indeterminate based on US features can go on further imaging with MRI, with characteristic feature of T2 homogeneous hypointensity and low signal on DWI rendering the lesion almost certainly benign [17,88].

### **MRI Pelvis Without IV Contrast**

Contrast-enhanced MRI performs superiorly to both US and noncontrast MRI due to its ability to confirm the presence of internal enhancing soft tissue components [18]. Both the ADNEX and O-RADS MRI risk stratification systems will have some decreased usefulness in the noncontrast setting given the limited ability to identify enhancing solid tissue and its enhancement pattern, both crucial for characterizing indeterminate lesions [17,71,73]. For example, the overall specificity for malignancy of the ADNEX MR system falls below 90% if used without dynamic contrast enhancement [71,87]. Sahin et al [19] proposed a noncontrast MRI score based on ADNEX and O-RADS models using morphologic assessment and DWI with an 84.9% sensitivity, 95.9% specificity, and 94% accuracy with the caveat of a population with a lower malignancy rate (15.1%) than the original ADNEX and O-RADS models population (18.8% and 18.4%). Noncontrast MRI may be used in adnexal mass characterization when the use of IV contrast is precluded.

### **US Duplex Doppler Pelvis**

Color or power Doppler should be included in the US examination of the pelvis. Color Duplex is used to evaluate vascularity of any developing solid component.

### **US Pelvis Transabdominal**

Transabdominal US may be performed without transvaginal imaging when the transvaginal examination cannot be tolerated or is contraindicated (eg, no prior history of sexual activity). The bladder should be full to provide the best acoustic window for evaluation.

## **US Pelvis Transabdominal and US Pelvis Transvaginal**

Indeterminate lesions are typically benign. In a multicenter prospective study of 303 indeterminate adnexal cysts, the incidence of malignancy was 3.6% [61]. In a second multicenter prospective study of 697 women, the prevalence of malignancy in indeterminate lesions ranged from 4.8% to 10.7% using SRU guidelines and IOTA simple rules, respectively [45].

If an indeterminate mass is identified on initial US, then follow-up may be performed either by serial US or by MRI. In a study of 1,363 postmenopausal women, complex adnexal masses ranging in size from 1 to 6 cm had an overall low risk of malignancy of 1.3%, with all epithelial cancer and borderline tumors demonstrating growth by 7 months of sonographic observation [89]. Similarly, in women diagnosed with early-stage high-grade serous cancers, these were rarely <5 cm or without solid components other than septations, further supporting potential observation in small masses [90].

Solid hypoechoic masses with smooth margins and acoustic shadowing and minimal Doppler flow are characteristic features of ovarian thecoma-fibroma group tumors, sex cord stromal neoplasms most commonly seen in the postmenopausal patient [91]. In a small study of 99 benign-appearing smooth purely solid masses, those with IOTA color score of 1 or 2, the risk of malignancy at 3 year follow-up was low, at 2%, suggesting conservative management may be an option for some patients with serial US imaging follow-up [92].

MRI may be able to assign a specific benign diagnosis or stratify for risk of malignancy, which may alter further imaging follow-up intervals [17,73].

If not requiring surgical management, indeterminate lesions that are well seen on US may be followed sonographically.

## **US Pelvis Transvaginal**

The most useful modality for evaluation of adnexal masses includes transvaginal US combined with transabdominal US approach.

**Variant 7: Adult patient assigned female at birth. Adnexal mass, suspicious for malignancy on pelvic US, no acute symptoms. Premenopausal or postmenopausal. Next imaging study for characterization.**

### **CT Pelvis With IV Contrast**

CT pelvis with IV contrast is not useful for further characterization of a suspicious adnexal lesion. Rather, the main role for CT is for staging of a known ovarian cancer, preoperative planning, and evaluation for surgical resectability, response to therapy, and identification of recurrent disease [10]. For more information on the staging and follow-up of ovarian cancer, please see the ACR Appropriateness Criteria® topic on “[Staging and Follow-up of Ovarian Cancer](#)” [10].

### **CT Pelvis Without and With IV Contrast**

CT pelvis without and with IV contrast is not useful for further characterization of a suspicious adnexal lesion.

Although not supported by the existing literature, CT of the pelvis without and with IV contrast may be potentially useful to determine if a suspected solid component within an adnexal lesion demonstrates enhancement.

### **CT Pelvis Without IV Contrast**

CT pelvis without IV contrast is not useful for further characterization of a suspicious adnexal lesion.

### **FDG-PET/CT Skull Base to Mid-Thigh**

FDG-PET/CT is useful for staging of ovarian cancer, specifically for identifying other sites of disease, and with better detection of lymph node metastasis than conventional CT [93].

### **MRI Pelvis Without and With IV Contrast**

On US, solid adnexal lesions with irregular contour are highly suspicious for malignancy with a 93% PPV for malignancy [24]. Similarly, lesions with >4 papillary structures or solid tissue with increased color or spectral Doppler flow are concerning for malignancy [34,37,62].

When a lesion has sonographic features worrisome for malignancy, the PPV of cancer ranges from 29% to 50% [23,45,55,61,62]. For example, in a prospective multicenter study of 970 lesions, solid component with blood flow had a 32% frequency of malignancy and up to 50% in women >60 years of age [55].

Contrast-enhanced MRI can be used to increase the specificity for malignancy, which may aid in surgical decision making and preoperative planning [17,71,73]. The presence or absence of enhancing solid tissue and enhancement

curve characteristics as evaluated on perfusion dynamic contrast-enhanced imaging drives the risk of malignancy on MRI [17,69,71,74-80]. Solid components with TIC with rapid enhancement greater than the myometrium (type 3) are only found in invasive malignant tumors with a sensitivity of 67% versus slow low level enhancement (type 1) found in benign tumors with a sensitivity of 70% and specificity of 89% [79]. Evaluation with TIC performs better than visual assessment with respective sensitivities of 96% and 76% in detection of borderline and invasive tumors in a set of 320 lesions [94].

#### **MRI Pelvis Without IV Contrast**

Contrast-enhanced MRI performs superiorly to both US and noncontrast MRI due to its ability to confirm the presence of internal enhancing soft tissue components [18]. Both the ADNEX and O-RADS MRI risk stratification systems will have some decreased usefulness in the noncontrast setting given the limited ability to identify enhancing solid tissue and its enhancement pattern, both crucial for characterizing indeterminate lesions [17,71,73]. For example, the overall specificity for malignancy of the ADNEX MR system falls below 90% if used without dynamic contrast enhancement [71,87]. Sahin et al [19] proposed a noncontrast MRI score based on ADNEX and O-RADS models using morphologic assessment and DWI with an 84.9% sensitivity, 95.9% specificity, and 94% accuracy with the caveat of a population with a lower malignancy rate (15.1%) than the original ADNEX and O-RADS models population (18.8% and 18.4%). Noncontrast MRI may be used in adnexal mass characterization when the use of IV contrast is precluded.

#### **Variant 8: Clinically suspected adnexal mass, no acute symptoms. Pregnant. Initial imaging.**

##### **CT Pelvis With IV Contrast**

CT pelvis with IV contrast has no role in the initial evaluation for an adnexal lesion and should be avoided in pregnant patients due to radiation dose.

##### **CT Pelvis Without and With IV Contrast**

CT pelvis without and with IV contrast has no role in the initial evaluation for an adnexal lesion and should be avoided in pregnant patients due to radiation dose.

##### **CT Pelvis Without IV Contrast**

CT pelvis without IV contrast has no role in the initial evaluation for an adnexal lesion and should be avoided in pregnant patients due to radiation dose.

##### **FDG-PET/CT Skull Base to Mid-Thigh**

FDG-PET/CT has no role in the initial evaluation for an adnexal lesion and should be avoided in pregnant patients due to radiation dose.

##### **MRI Pelvis Without and With IV Contrast**

Gadolinium-based contrast agents should not be routinely administered to pregnant patients [95]. Free gadolinium is toxic and thus administered in its chelated form. Gadolinium has been shown to cross the placenta and enter fetal circulation in nonhuman primate models. It has potential but is unclear or has unknown risks of exposure to the developing fetus [95,96]. A study by Ray et al [97] in 2016 showed a slightly increased risk of stillbirth or neonatal death (17.6/1,000 in exposed fetuses versus 6.9/1,000 in fetuses not undergoing MRI) and a slightly increased risk of childhood rheumatological, inflammatory, or infiltrative skin conditions. Gadolinium-based contrast agents are category C drugs as determined by the FDA, with adverse effects in animal studies without adequate studies in humans, and their use in pregnancy is restricted to situations where the potential benefits of imaging far outweigh the potential risk to the fetus [98].

A study by Thomassin-Naggara et al [99] in 2017 demonstrated an overall accuracy of MRI in up to 88% in pregnant patients using the ADNEX MR score in a subset of 36 masses. In this study, 7 of 31 patients received gadolinium contrast based on radiologist discretion during the examination, with all 7 demonstrating malignant tumors on final pathology.

##### **MRI Pelvis Without IV Contrast**

Although MRI can accurately diagnose the presence of adnexal lesions and identify distinguishing characteristics such as the type of fluid content, presence of fat, or presence of septations in cystic lesions [16,17], it is not the first-line modality for initial evaluation. MRI does not use ionizing radiation and is deemed safe in pregnant patients [95]. Although contrast-enhanced MRI performs superiorly to both US and noncontrast MRI due to its ability to confirm the presence of internal enhancing soft tissue components [18], gadolinium-based contrast agents should not be routinely administered to pregnant patients [95]. Although not specifically assessed in the pregnant

population, in a recent study of 350 lesions in a population with 15% malignant lesions, noncontrast MRI demonstrated a sensitivity of 85%, specificity of 96%, and accuracy of 94.2% to detect cancer [19].

If a pregnant patient with a suspected adnexal lesion is unable to be evaluated via US (due to large size of lesion >10 cm, poor acoustic window from adjacent viscera or body habitus, or unclear organ of origin), noncontrast MRI would be the best alternative imaging modality for evaluation.

### **US Duplex Doppler Pelvis**

Although considered a separate examination in the ACR documentation, color and power Doppler evaluation is considered an integral part of the complete transabdominal and transvaginal sonographic assessment of an adnexal lesion. Doppler can help identify internal soft tissue with vascular flow within a suspected adnexal lesion that can help differentiate malignancy from a solid-appearing component such as a clot or debris [20-22]. Optimal sonographic evaluation is achieved by using a combination of grayscale morphologic assessment and color or power Doppler imaging to detect flow within any solid areas. Color Doppler characteristics, namely a color score of 1 to 4 (ranging from no flow to very strong flow), and binary system of no flow versus very strong flow are used in O-RADS and IOTA simple rules classification systems, respectively [23,24]. Additionally, color Doppler evaluation can help to confirm the origin of a mass from the uterus rather than the ovary with the presence of “bridging vessel sign” [25]. No specific spectral Doppler parameters (resistive index, pulsatility index, peak systolic velocity time, time averaged  $V_{max}$ ) are currently used in clinical practice due to overlapping features of benign versus malignant lesions; however, spectral evaluation may be useful in distinguishing motion-related changes on color or power Doppler from true flow [20,21,26].

### **US Pelvis Transabdominal**

Although the most useful modality for the evaluation of adnexal masses is combined transabdominal and transvaginal pelvis US, a sole transabdominal approach is reasonable and may be the best option for the assessment of adnexal lesions late in gestation when the ovaries are displaced higher in the pelvis.

### **US Pelvis Transabdominal and US Pelvis Transvaginal**

Most adnexal lesions in pregnancy are benign and can be accurately characterized via US [100,101]. Widespread use of US in pregnancy and improved quality of US techniques has led to an increase in identification of incidental adnexal lesions. Incidence of adnexal lesions in pregnancy ranges from 1% to 6%, with a prevalence in pregnant women at live birth of 0.05% to 3.2% [29,102,103]. Up to 70% of all lesions resolve spontaneously, reflecting functional cysts [104]. In a study by Bernhard et al of 422 masses, predictors of persistence include size >5 cm and “complex” appearance on US, although even the majority of those with this appearance still resolved [29,102]. The most common persistent mass with pathologic diagnosis in pregnancy is the dermoid cyst, followed by cystadenoma [104]. The incidence of malignancy is approximately 0.8% to 6.8% of patients with persistent masses [29,100,102,105-107].

Endometriomas can be difficult to diagnose in pregnancy. In a study by Bailleux et al [108], in a set of 53 suspected endometriomas on US, of the 10 lesions with histopathologic diagnosis, only 4 were endometriomas, with others reflecting benign lesions including 4 mucinous cystadenomas. Endometriomas can undergo decidualization and lose their typical appearance in the setting of hormonal progesterone stimulation, enlarging and developing rounded vascularized papillary projections along a smooth wall mimicking malignancy [109]. Borderline tumors in pregnancy have been shown to demonstrate histopathologic features of aggressiveness relative to nonpregnant counterparts with described US features of anechoic or low level echoes, with papillary projections and irregular contour [110]. Dysgerminomas are the most common invasive malignancy in pregnancy and typically appear as a solid lesion with internal flow. Other pregnancy-specific ovarian lesions include hyperstimulated ovaries in the setting of ovulation induction and theca lutein cysts in the setting of gestational trophoblastic disease related to elevated  $\beta$ -HCG levels, both presenting with enlarged bilateral ovaries with multiple simple and/or hemorrhagic cysts. Similar findings are also seen in hyperreaction luteinalis, a hypersensitivity reaction to  $\beta$ -HCG. Luteomas are rare, heterogenous, solid-appearing vascular masses on US, which can mimic ovarian neoplasm, are associated with virilization of the mom and fetus, and regress after delivery [111].

US-based ovarian scoring systems have been applied to adnexal lesions in pregnant patients in a limited fashion in a few small studies. Czekierdowski et al [112] compared subjective assessment, Simple Rules Risk, and ADNEX models and found that subjective assessment performed best in a small study of 36 patients. Another larger study by Lee et al [113] with 236 women compared IOTA ADNEX and Sassone and Lerner systems, with the Sassone system or a combined model using 6 features that were found to be significant in their study performing the best.



## **US Pelvis Transvaginal**

The most useful modality for evaluation of adnexal masses includes transvaginal US combined with transabdominal US approach.

**Variant 9: Adnexal mass, indeterminate on initial pelvic US, no acute symptoms. Pregnant. Next imaging study for characterization.**

### **CT Pelvis With IV Contrast**

CT pelvis with IV contrast has no role in the further characterization for an indeterminate adnexal lesion and should be avoided in pregnant patients due to radiation dose.

### **CT Pelvis Without and With IV Contrast**

CT pelvis without and with IV contrast has no role in the further characterization for an indeterminate adnexal lesion and should be avoided in pregnant patients due to radiation dose.

### **CT Pelvis Without IV Contrast**

CT pelvis without IV contrast has no role in the further characterization for an indeterminate adnexal lesion and should be avoided in pregnant patients due to radiation dose.

### **FDG-PET/CT Skull Base to Mid-Thigh**

FDG-PET/CT has no role in further characterization of an indeterminate adnexal lesion in pregnancy, given the accuracy of US and MRI.

### **MRI Pelvis Without and With IV Contrast**

Gadolinium-based contrast agents should not be routinely administered to pregnant patients [95]. Free gadolinium is toxic and thus administered in its chelated form. Gadolinium has been shown to cross the placenta and enter fetal circulation in nonhuman primate models. It has potential but is unclear or has unknown risks of exposure to the developing fetus [95,96]. A study by Ray et al [97] in 2016 showed a slightly increased risk of stillbirth or neonatal death (17.6/1,000 in exposed fetuses versus 6.9/1,000 in fetuses not undergoing MRI) and slightly increased risk of childhood rheumatological, inflammatory, or infiltrative skin conditions. Gadolinium-based contrast agents are category C drugs as determined by the FDA, with adverse effects in animal studies without adequate studies in humans, and their use in pregnancy is restricted to situations where the potential benefits of imaging far outweigh the potential risk to the fetus [98].

A study by Thomassin-Naggara et al [99] in 2017 demonstrated an overall accuracy of MRI in up to 88% in pregnant patients using the ADNEX MR score in a subset of 36 masses. In this study, 7 of 31 patients received gadolinium contrast based on radiologist discretion during the examination, with all 7 demonstrating malignant tumors on final pathology.

### **MRI Pelvis Without IV Contrast**

MRI without contrast is useful for the evaluation of an US indeterminate adnexal lesion in pregnant patients who cannot receive gadolinium. MRI does not use ionizing radiation and is deemed safe in pregnant patients [95]. Up to 22% to 24% of adnexal masses remain indeterminate after US evaluation [61,62]. MRI can be helpful in the setting of indeterminate masses, large lesions >10 cm in size, and determination of origin in adnexal masses. Two recent studies by Bailleux et al [108] and Mascilini et al [110] in indeterminate cystic lesions in pregnancy highlight the difficulty in US diagnosis of endometriomas using the IOTA criteria and high proportion of benign lesions in the setting of avascular papillary projections, respectively.

The ADNEX and O-RADS MRI risk stratification system will have some decreased use in the noncontrast setting given limited ability to identify solid tissue and characterize its enhancement pattern [17,71,73]. Although the specificity of malignancy for the ADNEX MR system falls below 90% if used without dynamic contrast enhancement, it remains highly accurate for the diagnosis of a benign lesion (score 2), with an accuracy of 96.4% [71,87]. Although not specifically assessed in the pregnant population, Sahin et al [19] proposed a noncontrast MRI score based on the ADNEX and O-RADS models using morphologic assessment and DWI with an 84.9% sensitivity, 95.9% specificity, and 94% accuracy with the caveat of a population with a lower malignancy rate (15.1%) than the original ADNEX and O-RADS models population (18.8% and 18.4%). Diffusion restriction has also been shown to be useful in distinguishing decidualized endometriomas from ovarian cancers, with mural nodules in endometriomas demonstrating “T2 shine through” and higher ADC values and those with lower ADC values and restricted diffusion in keeping with malignancy [114].

## Summary of Recommendations

- **Variation 1:** US duplex Doppler pelvis, US pelvis transabdominal, US pelvis transabdominal and US pelvis transvaginal, and US pelvis transvaginal are usually appropriate as initial imaging of a premenopausal or postmenopausal adult patient with a clinically suspected adnexal mass with no acute symptoms. These procedures are complementary (ie, more than one procedure is ordered as a set or simultaneously in which each procedure provides unique clinical information to effectively manage the patient's care).
- **Variation 2:** US duplex Doppler pelvis, US pelvis transabdominal, US pelvis transabdominal and US pelvis transvaginal, and US pelvis transvaginal are usually appropriate as follow-up imaging of a premenopausal adult patient with an adnexal mass likely benign with no acute symptoms. These procedures are complementary (ie, more than one procedure is ordered as a set or simultaneously in which each procedure provides unique clinical information to effectively manage the patient's care).
- **Variation 3:** US duplex Doppler pelvis, US pelvis transabdominal, US pelvis transabdominal and US pelvis transvaginal, and US pelvis transvaginal are usually appropriate as follow-up imaging of a postmenopausal adult patient with an adnexal mass likely benign with no acute symptoms. These procedures are complementary (ie, more than one procedure is ordered as a set or simultaneously in which each procedure provides unique clinical information to effectively manage the patient's care).
- **Variation 4:** MRI pelvis without and with IV contrast is usually appropriate as the next imaging study for characterization for a premenopausal or postmenopausal adult patients with an adnexal mass that was indeterminate on initial pelvic US with no acute symptoms.
- **Variation 5:** US duplex Doppler pelvis, US pelvis transabdominal and US pelvis transvaginal, US pelvis transvaginal, and MRI pelvis without and with IV contrast are usually appropriate as the follow-up imaging on a premenopausal adult patient with an adnexal mass that was indeterminate on initial pelvic US with no acute symptoms. These procedures are complementary (ie, more than one procedure is ordered as a set or simultaneously in which each procedure provides unique clinical information to effectively manage the patient's care).
- **Variation 6:** US duplex Doppler pelvis, US pelvis transabdominal, US pelvis transabdominal and US pelvis transvaginal, US pelvis transvaginal, and MRI pelvis without and with IV contrast are usually appropriate as the follow-up imaging on a postmenopausal adult patient with an adnexal mass that was indeterminate on initial pelvic US with no acute symptoms. These procedures are complementary (ie, more than one procedure is ordered as a set or simultaneously in which each procedure provides unique clinical information to effectively manage the patient's care).
- **Variation 7:** MRI pelvis without and with IV contrast is usually appropriate as the next imaging study for characterization for a premenopausal or postmenopausal adult patient with an adnexal mass that is suspicious for malignancy on pelvic US, with no acute symptoms. The panel did not agree on recommending CT pelvis without and with IV contrast for patients in this clinical scenario. There is insufficient medical literature to conclude whether or not these patients would benefit from this procedure. Imaging with this procedure is controversial but may be appropriate.
- **Variation 8:** US duplex Doppler pelvis, US pelvis transabdominal, US pelvis transabdominal and US pelvis transvaginal, and US transvaginal are usually appropriate as the initial imaging for a pregnant patient with a clinically suspected adnexal mass with no acute symptoms. These procedures are complementary (ie, more than one procedure is ordered as a set or simultaneously in which each procedure provides unique clinical information to effectively manage the patient's care).
- **Variation 9:** MRI pelvis without IV contrast is usually appropriate as the next imaging study for characterization for a pregnant patient with an adnexal mass that is indeterminate on initial pelvic US with no acute symptoms.

## Supporting Documents

The evidence table, literature search, and appendix for this topic are available at <https://acsearch.acr.org/list>. The appendix includes the strength of evidence assessment and the final rating round tabulations for each recommendation.

For additional information on the Appropriateness Criteria methodology and other supporting documents go to [www.acr.org/ac](http://www.acr.org/ac).

### Safety Considerations in Pregnant Patients

Imaging of the pregnant patient can be challenging, particularly with respect to minimizing radiation exposure and risk. For further information and guidance, see the following ACR documents:

- [ACR–SPR Practice Parameter for the Safe and Optimal Performance of Fetal Magnetic Resonance Imaging \(MRI\)](#) [115]
- [ACR-SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation](#) [116]
- [ACR-ACOG-AIUM-SMFM-SRU Practice Parameter for the Performance of Standard Diagnostic Obstetrical Ultrasound](#) [117]
- [ACR Manual on Contrast Media](#) [118]
- [ACR Manual on MR Safety](#) [95]

### Appropriateness Category Names and Definitions

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	5	The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel’s recommendation. “May be appropriate” is the rating category and a rating of 5 is assigned.
Usually Not Appropriate	1, 2, or 3	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

### Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, because of both organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared with those specified for adults (see Table below). Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® [Radiation Dose Assessment Introduction](#) document [119].

Relative Radiation Level Designations		
Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
○	0 mSv	0 mSv
⊕	<0.1 mSv	<0.03 mSv
⊕⊕	0.1-1 mSv	0.03-0.3 mSv
⊕⊕⊕	1-10 mSv	0.3-3 mSv
⊕⊕⊕⊕	10-30 mSv	3-10 mSv
⊕⊕⊕⊕⊕	30-100 mSv	10-30 mSv

\*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (eg, region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as “Varies.”

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The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient’s clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient’s condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.