

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

Variant 1: Clinically suspected adnexal mass, no acute symptoms. Premenopausal. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transvaginal	Usually Appropriate	○
US pelvis transabdominal	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 and 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 2: Clinically suspected adnexal mass, no acute symptoms. Postmenopausal. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transvaginal	Usually Appropriate	○
US pelvis transabdominal	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 and 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 3: Adnexal mass, likely benign, no acute symptoms. Premenopausal. Initial follow-up.

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transvaginal	Usually Appropriate	○
US pelvis transabdominal	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 and 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 4: Adnexal mass, likely benign, no acute symptoms. Postmenopausal. Initial follow-up.

Procedure	Appropriateness Category	Relative Radiation Level
US pelvis transvaginal	Usually Appropriate	○
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transabdominal	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 and 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 5: Adnexal mass, indeterminate, no acute symptoms. Premenopausal. Initial follow-up.

Procedure	Appropriateness Category	Relative Radiation Level
US pelvis transvaginal	Usually Appropriate	○
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transabdominal	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 and 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 6:**Adnexal mass, indeterminate, no acute symptoms. Postmenopausal. Initial follow-up.**

Procedure	Appropriateness Category	Relative Radiation Level
US pelvis transvaginal	Usually Appropriate	○
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transabdominal	Usually Appropriate	○
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 7:**Adnexal mass, highly suspicious for malignancy, no acute symptoms. Premenopausal and postmenopausal. Initial follow-up.**

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

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

Procedure	Appropriateness Category	Relative Radiation Level
US duplex Doppler pelvis	Usually Appropriate	○
US pelvis transabdominal	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 and 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	⊗⊗⊗⊗

CLINICALLY SUSPECTED ADNEXAL MASS, NO ACUTE SYMPTOMS

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Summary of Literature Review

Introduction/Background

There are approximately 9.1 pelvic surgeries performed for every histologically confirmed adnexal malignancy in the United States [1] compared with 2.3 surgeries per malignancy (in oncology centers) and 5.9 surgeries per malignancy (in other centers) by the European International Ovarian Tumor Analysis (IOTA) center trials [2]. There are 21,290 women who are found to have ovarian cancer in the United States per year, whereas 200,000 women undergo surgery for a pelvic mass [3].

After stage, the second most important prognostic factor in long-term survival in patients with ovarian malignancy is the initial management by a gynecological oncologist. [4]. Nonetheless, only 33% of women with an eventual diagnosis of ovarian cancer are referred to a gynecologic oncologist for that initial management [5]. Please see the ACR Appropriate Criteria for "[Staging and Follow-up of Ovarian Cancer](#)" [6]. With the improved accuracy of imaging for adnexal mass characterization and consequent appropriate triage to subspecialty referral, better use of gynecologic oncology can improve treatment outcomes [7]. It is also important to note that surgical exploration of benign lesions is not without consequences, with reported complication rates ranging from 2% to 15% [8,9]; thus, it is important to improve preoperative characterization of adnexal masses.

Adnexal masses can be diagnosed with specific features on ultrasound (US) or MRI as benign (ie, functional masses, dermoid, endometrioma, fibroma, pedunculated fibroid, hydrosalpinx, peritoneal inclusion cyst, Tarlov cyst), malignant, or indeterminate [7,10].

Special Imaging Considerations

Quantitative MRI

Diffusion-weighted MRI sequences, both qualitative [11,12] and quantitative [13], as well as perfusion-weighted MRI sequences are reported to improve accuracy in distinguishing benign from malignant adnexal lesions compared with conventional MRI alone, having an accuracy rate of 95% with the combined technique [14]. Other advanced MRI techniques, such as semiquantitative and quantitative dynamic contrast-enhanced MRI, have also been proposed as potentially useful supplements to the traditional MRI sequences [15-17]. Gadolinium is not recommended in the assessment of adnexal masses during pregnancy [18]. Please see the ACR *Manual on Contrast Media* for additional information [19].

FDG-PET/CT

The sensitivity and specificity of PET using the tracer fluorine-18-2-fluoro-2-deoxy-D-glucose (FDG)/CT in evaluating suspected adnexal masses in asymptomatic females are only 58% and 76%, respectively. However, PET may play a role in women with a known history of malignancy who present for evaluation of an adnexal mass to identify other sites of disease [20]. A small series of 18 patients showed that FDG-PET was of clinical

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value when assessing suspicious malignant adnexal masses [21]. However, borderline (low malignant potential) tumors or leiomyomas can cause false-positive results with this technique [21]. PET imaging should generally be avoided in pregnant patients.

Contrast-Enhanced US

Two-dimensional contrast-enhanced US (CEUS) can be a useful technique to show in real time if an indeterminate ovarian lesion demonstrates any internal vascularity. Presence of enhancement in a solid mass or a nodule on CEUS, not shown by color or power Doppler, would make the existence of malignancy more likely [22] and could potentially obviate the need for contrast-enhanced MRI. Enhancement that is earlier than or simultaneous to myometrial tissue was found in 93.8% of malignant lesions, as compared with 12.5% of benign lesions in one study [22,23]. Using 3-D CEUS [24,25] as well as 3-D contrast-enhanced power Doppler US [26] is suggested to be useful tools to supplement traditional US and 2-D CEUS. The additional value of CEUS to evaluate adnexal masses is not validated.

No data are available pertaining to the safety of US contrast in pregnancy; therefore, CEUS is not approved during pregnancy.

Discussion of Procedures by Variant

Variant 1: Clinically suspected adnexal mass, no acute symptoms. Premenopausal. Initial imaging.

Transvaginal US is an essential component of a pelvic US examination in the female population. Sonomorphologically, most adnexal masses can be described as cystic, solid, or mixed cystic and solid. US can triage the majority of adnexal masses into benign or malignant categories. In indeterminate cases, MRI is often helpful to further characterize the lesion and assign a benign or malignant diagnosis.

US Pelvis Transvaginal

Cystic Masses

Characterization of an adnexal mass as a cyst is important for management. US identification of a simple cyst establishes a benign process in 98.7% of premenopausal women [27,28]. A 2009 consensus conference by the Society of Radiologists in Ultrasound reviewed the management of asymptomatic ovarian and other adnexal cysts [10]. Most simple cysts in premenopausal women are functional in nature and will resolve spontaneously. Most nonsimple cysts in premenopausal women are functional as well and have characteristic findings that indicate their benign nature. For example, the combined sonographic characteristics of a spiderweb-appearing or retracting clot and presence of peripheral vascularity are diagnostic of a hemorrhagic cyst. Most nonfunctional cysts are benign and can be accurately diagnosed when they have specific features as follows: 1) endometriomas (low-level internal echoes, mural echogenic foci, or nonvascular solid attenuating components on US) [29], 2) teratomas (echogenic attenuating component or small horizontal interfaces on US) [29], 3) hydrosalpinges (tubular cystic mass with or without folds), 4) peritoneal inclusion cysts (cystic masses taking the shape of the underlying space located adjacent to or surrounding a functioning ovary), or 5) Tarlov cysts (deep cystic masses communicating with sacral foramina [30]). These characteristic sonographic features, among others, have been well documented in the literature [7,10,30].

Solid Masses

The most common solid adnexal mass in the nonacute setting is a pedunculated leiomyoma (or “myoma” or “fibroid”). Leiomyomas are the most common uterine neoplasms and are prevalent in approximately 20% to 30% of women >30 years of age [31]. Pedunculated or broad ligament fibroids sometimes can be mistaken for solid ovarian or adnexal masses. Careful search for and identification of normal ovaries that may be displaced by uterine myomas and blood supply from uterine vessels help avoid this error [29].

Solid ovarian masses include benign ovarian tumors such as mature teratomas (variable appearance of cystic, solid or cystic and solid), fibromas, thecomas, Brenner tumors, malignant ovarian tumors (primary and metastatic), chronic ectopic pregnancy, and a chronically torsed ovary/massive ovarian edema. The most common ovarian neoplasm in women of reproductive age is a benign cystic teratoma, which has a broad spectrum of US appearances and can be diagnosed correctly by US in most cases. Most fibrothecoma tumors can be diagnosed on US by the presence of a predominant hypoechoic attenuating component [29].

Indeterminate Masses

Masses without the specific features mentioned above are considered indeterminate [7]. A simple cyst or unilocular cyst has no or very small chance of becoming malignant (<0.4%) [32]. A single thin septation <3 mm

is considered benign [32]. Multiple septations without papillary projections or solid component are unlikely to be malignant [32]. Cysts with one or a few small papillary projections that are <3 mm are likely to be benign [32]. A number of sonographic predictors have been designed to reduce the number of unnecessary surgeries and triage patients with high risk of malignancy to the gynecology oncologists and low-risk masses to the general gynecologist. The IOTA group Simple Rules appear to perform better than Risk of Malignancy Index (RMI) and equal to logistic regression of IOTA rules [2] to predict risk of malignancy [33]. Utilization of IOTA Simple Rules resulted in a sensitivity and specificity, respectively, of 93% [95% CI: 89%–95%] and 81% [95% CI: 76%–85%].

The IOTA Simple Rules include 10 features; 5 of them (B features) are used to predict a benign adnexal mass and the other 5 (M features) to predict a malignant mass. B features include unilocular cyst, solid components present but <7 mm, acoustic shadows, smooth multilocular tumor, largest diameter <100 mm, and no blood flow. Malignant features include irregular solid tumor, ascites, at least 4 papillary structures, irregular multilocular-solid tumor, largest diameter 100 mm, and very strong flow [33].

Color, Power, and Spectral Doppler US Pelvis

Color or power Doppler should be included in the US examination of the female pelvis. The use of color or power Doppler adds significant contributions to differentiating between benign and malignant masses by differentiating a true solid component from a solid-appearing component or debris within a cyst. In addition, color or power Doppler can help confirm that the origin of an adnexal mass is from the uterus rather than the ovary by the presence of a bridging-vessel sign, and is recommended as an integral part of the US examination, especially for indeterminate masses [34,35]. Malignant masses generally demonstrate neovascularity. More recent studies have established that spectral Doppler US parameters (resistive index, pulsatility index, peak systolic velocity, time-averaged V_{max}) do not provide any significant improvement over morphologic assessment; therefore, the value of spectral Doppler analysis is limited [36,37]. However, spectral Doppler is useful to differentiate motion-related changes on color or power Doppler from true flow. 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 [23,36,37]. Assessment of papillary projections or solid tumor areas with 3-D power Doppler may be helpful in reducing the false-negative rate of benign indeterminate cystic adnexal masses [38]. In one series, when 3-D power Doppler was added to the RMI, the sensitivity for the prediction of malignancy increased from 88% to 99% [39]. However, 3-D US is not considered standard in the US evaluation of adnexal masses, considering the paucity of available literature.

The combination of color Doppler with serum cancer antigen (CA)-125 has been proposed to increase sensitivity for differentiating benign from malignant ovarian tumors [40]. In 2 studies, when increasing the cut-off point of serum CA-125 from 35 U/mL to 65 U/mL in the presence of resistive index <0.5, the best specificity (100%) and positive predictive value (100%) were reached [41,42]. However, it is important to note that while the majority of malignant ovarian tumors were correctly classified using US, CA-125 alone performed worse than US in distinguishing benign from malignant lesions considering it may be low with borderline and low-grade malignant tumors. In fact, CA-125 levels improved the specificity of diagnosing a malignant ovarian tumor only in those lesions already suspected to be malignant on US [43].

US Pelvis Transabdominal

Transabdominal US should be included in the US examination of the female pelvis. It is especially helpful in the presence of a large mass not optimally assessed on the transvaginal US.

MRI Pelvis

When an adnexal mass is indeterminate on US, either the organ of origin is uncertain or it is unclear whether the mass is benign or malignant, then MRI with intravenous (IV) contrast (if feasible) becomes the modality of choice [44]. MRI can be used to determine the origin of a mass (uterine, ovarian, or tubal) and help distinguish benign from malignant masses. On MRI, identification of vascular vegetations in cystic masses and ascites is the best indicator of malignancy. A meta-analysis comparing the incremental value of a second test to evaluate an indeterminate adnexal mass on grayscale US found that contrast-enhanced MRI contributed to a greater probability of ovarian cancer than CT, Doppler US, or MRI without IV contrast [45]. After secondary testing for suspicious lesions, the posttest probability increased more after nonenhanced (premenopausal women, 70%; postmenopausal women, 92%) or contrast-enhanced MRI (premenopausal women, 80%; postmenopausal women, 95%) than it did after combined grayscale and Doppler US (premenopausal women, 30%; postmenopausal women, 69%) or CT (premenopausal women, 38%; postmenopausal women, 76%) ($P < .001$). In addition, MRI

increases confidence in the diagnosis of mature cystic teratoma and leiomyoma [46]. In one small series, MRI was able to characterize indeterminate adnexal masses seen on US, with a sensitivity of 100% for identifying malignancy and a specificity of 94% for benignity [47]. Other studies have also shown high sensitivity and specificity of MRI to evaluate adnexal masses [42,45]. Therefore, women who clinically have a low risk of malignancy but have indeterminate lesions on US will most likely benefit from contrast-enhanced MRI [42,45,48].

MRI can readily diagnose typical endometriomas, which present with a high T1 and low T2 signal intensity or multiple high T signal masses. Dermoids are diagnosed by the presence of fat on the fat-saturated sequence or by a drop in signal relative to the opposed phase sequences when there is a small amount of intravoxel fat. MRI is the preferred modality to supplement US to confirm the presence of fat, considering the higher accuracy compared to CT. Fibromas typically show a homogeneous low T2 signal with mild to moderate enhancement, and MRI is useful to determine enhancement in an apparently nonenhancing nodule on US [44].

In studies comparing precontrast and contrast-enhanced MRI, the receiver-operator characteristic (ROC) analysis of contrast-enhanced MRI was shown to be significantly better than precontrast MRI for adnexal mass characterization [15,49].

CT Pelvis

CT is usually not indicated for the workup and characterization of adnexal masses without acute symptoms because of its poor soft-tissue discrimination in the adnexal region. Some diagnostic features, such as calcifications (such as teeth in a teratoma), presence of macroscopic fat, or uniform simple fluid attenuation, can serve to characterize an adnexal mass when the lesion is initially discovered on CT [50]. As the diagnostic roles of US and MRI are better established, there is no reason presently to obtain a CT to evaluate adnexal pathology other than for cancer staging.

FDG-PET/CT Skull Base to Mid-Thigh

There is no relevant literature regarding the use of FDG-PET/CT in the evaluation of clinically suspected adnexal mass.

Variant 2: Clinically suspected adnexal mass, no acute symptoms. Postmenopausal. Initial imaging.

US Pelvis Transvaginal

Transvaginal US is an essential component of a pelvic US examination in the female population. Morphologically, adnexal masses are predominantly cystic, solid, or mixed cystic and solid. US can triage the majority of adnexal masses into benign or malignant categories. In indeterminate cases, MRI is often helpful to further characterize the lesion and assign a benign or malignant diagnosis.

Cystic Masses

Characterization of an adnexal mass as a cyst is important for management. US identification of a simple cyst establishes a benign process in 100% of postmenopausal women [27,28]. A 2009 consensus conference at the Society of Radiologists in Ultrasound reviewed the management of asymptomatic ovarian and other adnexal cysts [10]. In postmenopausal women, simple cysts are seen with a frequency of 17% to 24% and are not related to hormonal therapy or time since onset of menopause, although some have observed decreasing frequency with time after the onset of menopause [51]. In a prospective study evaluating natural history of postmenopausal simple adnexal cysts, 53% disappeared completely, 28% remained constant in size, 11% enlarged by ≥ 3 mm, 3% decreased in size by ≥ 3 mm, and 6% both increased and decreased in size on repeated examinations. No statistical relationship was found between presence of cysts or cyst activity with respect to the type of hormone replacement or length of time since menopause [52].

Most cysts are benign and can be accurately diagnosed when they have specific features of endometriomas (less common in postmenopausal) (low-level internal echoes, mural echogenic foci, or nonvascular solid attenuating components on US) [29], teratomas (echogenic attenuating component or small horizontal interfaces on US) [29], hydrosalpinges (tubular cystic mass with or without folds), or Tarlov cysts (deep cystic masses communicating with sacral foramina [30]).

Solid Masses

The most common solid adnexal mass is a pedunculated leiomyoma (or “myoma” or “fibroid”). Leiomyomas are the most common uterine neoplasms and are prevalent in approximately 20% to 30% of women >30 [31]. Pedunculated fibroids sometimes can be mistaken for solid ovarian masses. Careful search for and identification

of normal ovaries that may be displaced by uterine myomas and blood supply from uterine vessels help avoid this error [29].

Solid ovarian masses include benign ovarian tumors such as mature teratomas, fibromas, thecomas, Brenner tumors and a chronically torsed ovary, and malignant ovarian tumors (primary and metastatic). The most common mature cystic teratoma is a dermoid, which has a broad spectrum of US appearances and can be diagnosed correctly by US in most cases. Most fibrothecoma tumors can be diagnosed on US by the presence of hypoechoic attenuating component [29]. Most malignant ovarian masses can be diagnosed by US or MRI when there is enhancing solid components or enhancing mural nodules or papillary projections [5].

Indeterminate Masses

Masses without the specific features mentioned above are considered indeterminate [7]. A simple cyst or unilocular cyst has no or a very small chance of becoming malignant (<0.4%) [32]. A single thin septation <3 mm is considered benign [32]. Multiple septations without papillary projections or solid component are unlikely to be malignant [32]. Cysts with one or a few small papillary projections that are <3 mm are likely to be benign [32].

Color, Power, and Spectral Doppler US Pelvis

Color or power Doppler should be included in the US examination of the female pelvis. The use of color or power Doppler adds significant contributions to differentiating between benign and malignant masses by differentiating a true solid component from a solid-appearing component or debris within a cyst. In addition, color or power Doppler can help confirm that the origin of an adnexal mass is from the uterus rather than the ovary by the presence of a bridging-vessel sign, and is recommended as an integral part of the US examination, especially for indeterminate masses [34,35]. Malignant masses generally demonstrate neovascularity. More recent studies have established that spectral Doppler US parameters (resistive index, pulsatility index, peak systolic velocity, time-averaged V_{max}) do not provide any significant improvement over morphologic assessment; therefore, the value of spectral Doppler analysis is limited [36,37]. However, spectral Doppler is useful to differentiate motion-related changes on color or power Doppler from true flow. Hence, color or power Doppler is indicated in the assessment of any indeterminate or solid adnexal mass. 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 [23,36,37]. Assessment of papillary projections or solid tumor areas with 3-D power Doppler may be helpful in reducing the false-negative rate of benign indeterminate cystic adnexal masses [38]. In one series, when 3-D power Doppler was added to the RMI, the sensitivity for the prediction of malignancy increased from 88% to 99% [39]. However, 3-D US is not considered a requirement in US evaluation of adnexal mass, considering paucity of available literature.

The combination of color Doppler with serum CA-125 has been proposed to increase sensitivity for differentiating benign from malignant ovarian tumors [40]. In 2 studies, when increasing the cut-off point of serum CA-125 from 35 U/mL to 65 U/mL in the presence of resistive index <0.5, the best specificity (100%) and positive predictive value (100%) were reached [41,42]. However, it is important to note that while the majority of malignant ovarian tumors were correctly classified using US, CA-125 alone performed worse than US in distinguishing benign from malignant lesions considering it may be low with low-grade and low malignant potential lesions. In fact, CA-125 levels improved the specificity of diagnosing a malignant ovarian tumor only in those lesions already suspected to be malignant on US [43].

US Pelvis Transabdominal

Transabdominal US should be included in the US examination of the female pelvis. It is especially helpful in the presence of a large mass, which is not optimally assessed on the transvaginal US.

MRI Pelvis

When an adnexal mass is indeterminate on US, either the organ of origin is uncertain, or it is not clear if it is benign or malignant, then MRI with IV contrast (if feasible) becomes the modality of choice [44]. MRI can be used to determine the origin of a mass (uterine, ovarian, or tubal) and help distinguish benign from malignant masses with an overall accuracy of 91% for the diagnosis of malignancy. On MRI, identification of vascular vegetations in cystic masses and ascites is the best indicator of malignancy. A meta-analysis comparing the incremental value of a second test to evaluate an indeterminate adnexal mass on grayscale US found that contrast-enhanced MRI contributed to a greater probability of ovarian cancer than CT, Doppler US, or MRI without IV contrast [45]. After secondary testing for suspicious lesions, the posttest probability increased more after nonenhanced (premenopausal women, 70%; postmenopausal women, 92%) or contrast-enhanced MR imaging

(premenopausal women, 80%; postmenopausal women, 95%) than it did after combined grayscale and Doppler US (premenopausal women, 30%; postmenopausal women, 69%) or CT (premenopausal women, 38%; postmenopausal women, 76%) ($P < .001$). In addition, MRI increases confidence in the diagnosis of mature cystic teratoma and leiomyoma [46]. In one small series, MRI was able to characterize indeterminate adnexal masses seen on US, with a sensitivity of 100% for identifying malignancy and a specificity of 94% for benignity [47]. Other studies have also shown high sensitivity and specificity of MRI to evaluate adnexal masses [42,45]. Therefore, women who clinically have a low risk of malignancy but have indeterminate lesions on US will most likely benefit from contrast-enhanced MRI [42,45,48]. In addition, MRI is useful to document the presence of enhancement in a nodule on US without Doppler flow [44].

Most endometriomas have a high T1 and low T2 signal on MRI. Contrast-enhanced MRI is important when evaluating patients with endometriomas that are due to the rare association with malignancy. Dermoids are diagnosed by the presence of fat on the fat-saturated sequence or by a drop in signal in out-of-phase sequences when there is a small amount of fat. MRI is the preferred modality to supplement US to look for fat, considering its higher accuracy than CT. Fibromas typically show low T2 signal and some enhancement [44].

In a study comparing precontrast and contrast-enhanced MRI, ROC analysis of contrast-enhanced MRI was shown to be significantly better than precontrast MRI for adnexal mass characterization [15,49].

CT Pelvis

CT is usually not indicated for the workup and characterization of adnexal masses without acute symptoms because of its poor soft-tissue discrimination in the adnexal region. Some diagnostic features, such as calcifications (such as teeth in a teratoma), presence of macroscopic fat, or uniform simple fluid attenuation, can serve to characterize an adnexal mass when the lesion is initially discovered on CT [50]. As the diagnostic roles of US and MRI are better established, presently there is no reason to obtain a CT to evaluate adnexal pathology other than for cancer staging.

FDG-PET/CT Skull Base to Mid-Thigh

There is no relevant literature regarding the use of FDG-PET/CT in the evaluation of asymptomatic clinically suspected adnexal mass.

Variant 3: Adnexal mass, likely benign, no acute symptoms. Premenopausal. Initial follow-up.

US Pelvis Transvaginal

Adnexal masses with benign features that are optimally seen on US can be followed by US. Functional cysts with typical features measuring <5 cm do not require follow-up. If required, the optimal time for the follow-up evaluation of a potential functional cyst is within the first 7 to 10 days or in 2 to 3 months after the onset of menses in order to avoid confusion with a new hemorrhagic cyst. Change in the appearance and size of the cyst on follow-up help with differentiation from a pathological adnexal mass. Typically, functional hemorrhagic cysts will resolve, whereas nonfunctional masses will persist. Most nonfunctional cysts in premenopausal women with sonographically benign features measuring <6 cm in diameter have been shown to remain unchanged during long-term follow-up [53]. Therefore, it is possible to manage these lesions safely by US follow-up rather than surgical intervention in asymptomatic women [53]. Endometriotic cysts require follow-up because of the small risk (<1%) of malignant transformation [54]. Other benign lesions (cystic or solid) that are not operated on can be followed by US.

Color, Power, and Spectral Doppler US Pelvis

Color or power Doppler should be included in the US examination of the female pelvis. Color Duplex is utilized to evaluate vascularity of any developing solid component and to determine the origin of an adnexal mass.

US Pelvis Transabdominal

Transabdominal US should be included in the follow-up of adnexal masses. It is especially helpful in the presence of a large mass or enlarging mass and is not optimally assessed on the transvaginal US.

MRI Pelvis

MRI with IV contrast (if feasible) can be performed to follow large benign masses that cannot be optimally visualized by US or masses with unexplained change of appearance during US follow-up. In a study comparing precontrast and contrast-enhanced MRI, ROC analysis of contrast-enhanced MRI was shown to be significantly better than precontrast MRI [15,49].

CT Pelvis

CT is usually not indicated to follow likely or known benign adnexal masses. As 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 indication for the use of FDG-PET/CT in the follow-up of benign adnexal masses in premenopausal women.

Variant 4: Adnexal mass, likely benign, no acute symptoms. Postmenopausal. Initial follow-up.

US Pelvis Transvaginal

In postmenopausal women, simple cysts are seen with a frequency of 17% to 24% and are not related to hormonal therapy or time since onset of menopause, although some have observed decreasing frequency with time after the onset of menopause [51]. In a prospective study evaluating natural history of postmenopausal simple adnexal cysts, 53% disappeared completely, 28% remained constant in size, 11% enlarged by ≥ 3 mm, 3% decreased in size by ≥ 3 mm, and 6% both increased and decreased in size on repeated examinations. No statistical relationship was found between presence of cysts or cyst activity with respect to the type of hormone replacement or length of time since menopause [52]. In a screening program of women over 55 years of age, simple cysts were present in 14% of women; 54% of them persisted at 1 year [30]. Endometriotic cysts are followed up because of the small risk (<1%) of malignant transformation [54]. Other benign lesions (cystic or solid) that are not operated on can be followed by US for growth and small chance of malignancy (1% in dermoids, and potentially in surface epithelial tumors).

Color, Power, and Spectral Doppler US Pelvis

Color or power Doppler should be included in the US examination of the female pelvis. Color Duplex is utilized to evaluate vascularity of any developing solid component and to determine the origin of an adnexal mass.

US Pelvis Transabdominal

Transabdominal US should be included in the follow-up of adnexal masses. It is especially helpful in the presence of a large mass or enlarging mass and is not optimally assessed on the transvaginal US.

MRI Pelvis

MRI with IV contrast (if feasible) can be performed to follow large benign masses that cannot be optimally visualized by US or masses with unexplained change of appearance during US follow-up. However, in a study comparing precontrast and contrast-enhanced MRI, ROC analysis of contrast-enhanced MRI was shown to be significantly better than precontrast MRI [15,49].

CT Pelvis

CT is usually not indicated to follow likely or known benign adnexal masses. As 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 indication for the use of FDG-PET/CT in the follow-up of benign adnexal masses in postmenopausal women.

Variant 5: Adnexal mass, indeterminate, no acute symptoms. Premenopausal. Initial follow-up.

US Pelvis Transvaginal

If an indeterminate mass is identified on initial US, then follow-up may be performed either by serial US or by MRI. The former will be helpful to assess if this is a functional lesion that is either resolving or undergoing a typical evolution (as with a larger hemorrhagic cyst). MRI may be able to assign a specific benign diagnosis or characterize the lesion as malignant, thus requiring no further US follow-up in the majority of cases [7]. The optimal time for the follow-up US evaluation of potential functional cyst is in 6-weeks' time (scheduled for the first half of the following menstrual cycle) to increase the probability of resolution and minimize confusion with a new hemorrhagic cyst. Others advocate waiting 2 to 3 months in order to permit time for resolution of a functional cyst or confirm persistence of a nonfunctional cyst. There is no absolute consensus on the ideal time interval for follow-up. If the lesion persists and is stable in size and appearance, serial follow-up may be appropriate, depending on the clinical context and features present.

Color, Power, and Spectral Doppler US Pelvis

Color or power Doppler should be included in the US examination of the female pelvis. Color Duplex is utilized to evaluate vascularity of any developing solid component and to determine the origin of an adnexal mass.

US Pelvis Transabdominal

Transabdominal US should be included in the follow-up of adnexal masses. It is especially helpful in the presence of a large mass or enlarging mass and is not optimally assessed on the transvaginal US.

MRI Pelvis

An indeterminate mass that has been evaluated by contrast-enhanced MRI and has not undergone surgery can be followed by contrast-enhanced MRI (if feasible), if the mass cannot be optimally visualized by US or if the mass shows an unexplained change of appearance during US follow-up.

In a study comparing precontrast and contrast-enhanced MRI, ROC analysis of contrast-enhanced MRI was shown to be significantly better than precontrast MRI [15,49].

CT Pelvis

CT is usually not indicated to follow indeterminate adnexal masses. As the roles of US and MRI are well established, there is little reason presently to obtain a CT for indeterminate mass follow-up.

FDG-PET/CT Skull Base to Mid-Thigh

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

Variant 6: Adnexal mass, indeterminate, no acute symptoms. Postmenopausal. Initial follow-up.

US Pelvis Transvaginal

Indeterminate masses in postmenopausal women are generally benign. They can be followed conservatively with US unless they are not optimally visualized or there is an unexplained change of appearance. In postmenopausal women, simple cysts are seen with a frequency of 17% to 24% and are not related to hormonal therapy or time since onset of menopause, although some have observed decreasing frequency with time after the onset of menopause [51]. In a prospective study evaluating the natural history of postmenopausal simple adnexal cysts, 53% disappeared completely, 28% remained constant in size, 11% enlarged by ≥ 3 mm, 3% decreased in size by ≥ 3 mm, and 6% both increased and decreased in size on repeated examinations. No statistical relationship was found between presence of cysts or cyst activity with respect to the type of hormone replacement or length of time since menopause [52].

Other indeterminate masses with indeterminate features that remain stable undergo serial US follow-up if there is no plan for surgery.

Color, Power, and Spectral Doppler US Pelvis

Color or power Doppler should be included in the US examination of the female pelvis. Color Duplex is utilized to evaluate vascularity of any developing solid component and to determine the origin of an adnexal mass.

US Pelvis Transabdominal

Transabdominal US should be included in the follow-up of adnexal masses. It is especially helpful in the presence of a large mass or enlarging mass, not optimally assessed on the transvaginal US.

MRI Pelvis

An indeterminate mass that has been evaluated by contrast-enhanced MRI and has not undergone surgery can be followed by contrast-enhanced MRI (if feasible) if the mass cannot be optimally visualized by US or if the mass shows an unexplained change of appearance during US follow-up.

In a study comparing precontrast and contrast-enhanced MRI, ROC analysis of contrast-enhanced MRI was shown to be significantly better than precontrast MRI [49].

CT Pelvis

CT is usually not indicated to follow known indeterminate adnexal masses. As the roles of US and MRI are well established, there is little reason presently to obtain a CT for indeterminate mass follow-up.

FDG-PET/CT Skull Base to Mid-Thigh

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

Variant 7: Adnexal mass, highly suspicious for malignancy, no acute symptoms. Premenopausal and postmenopausal. Initial follow-up.

US Pelvis Transvaginal

Once US confirms the clinical impression of a highly suspicious malignant adnexal mass, CT is the modality of choice for staging and follow-up of patients posttreatment. US can be performed as a problem-solving modality to further assess a finding that would require further characterization following CT.

Color, Power, and Spectral Doppler US Pelvis

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

US Pelvis Transabdominal

With masses highly suspicious for malignancy, CT is the modality of choice for staging and follow-up posttreatment.

MRI Pelvis

MRI with IV contrast (if feasible) can be performed as a problem solver to further assess a finding that would require further characterization following CT and US.

CT Pelvis

Pelvic CT is not indicated when there is high suspicion of adnexal origin malignancy.

CT Abdomen and Pelvis

CT with IV contrast (if feasible) is the main modality to follow patients with high suspicion of adnexal origin malignancy, both at the time of initial diagnosis for staging and after treatment to determine response to treatment and exclude recurrence (see the ACR Appropriateness Criteria® topic on “[Staging and Follow-up of Ovarian Cancer](#)” [6]). US and MRI are used as problem-solving modalities.

FDG-PET/CT

FDG-PET/CT may play a role in women with a known history of malignancy who present for evaluation of an adnexal mass to identify other sites of disease [20].

Variant 8: Clinically suspected adnexal mass, no acute symptoms. Pregnant. Initial imaging and follow-up.

US Pelvis

US is the modality of choice for assessing suspected adnexal lesions in pregnant patients. It is both safe and reliable in most instances [55,56].

US Pelvis Transvaginal

Transvaginal US is an essential component of a pelvic US examination in the pregnant population. Morphologically, adnexal masses are predominantly cystic, solid, or mixed.

Cystic Masses

Characterization of an adnexal mass as a cyst is important for management. US identification of a simple cyst establishes a benign process in 100% of premenopausal women [27,28]. A 2009 consensus conference at the Society of Radiologists in Ultrasound reviewed the management of asymptomatic ovarian and other adnexal cysts [10]. Most cysts in premenopausal women are functional in nature and will resolve spontaneously. Most nonsimple cysts are functional as well. The sonographic characteristics of spiderweb-appearing or retracting clot and presence of mural vascularity suggest the diagnosis. Most nonsimple cysts are functional as well. The sonographic characteristics suggest the diagnosis, and a follow-up US can be performed to document resolution of functional cysts. Most nonfunctional cysts are benign and can be accurately diagnosed when they have specific features of endometriomas (low-level internal echoes, mural echogenic foci, or nonvascular solid attenuating components on US) [29], teratomas (echogenic attenuating component or small horizontal interfaces on US) [29], hydrosalpinges (tubular cystic mass with or without folds), peritoneal inclusion cysts (cystic masses taking the shape of the underlying space located adjacent to a functioning ovary), or Tarlov cysts (deep cystic masses communicating with sacral foramina [30]).

Solid Masses

The most common solid adnexal mass is a pedunculated leiomyoma (or “myoma” or “fibroid”). Leiomyomas are the most common uterine neoplasms and are prevalent in approximately 20% to 30% of women ≥ 30 [31]. Pedunculated fibroids sometimes can be mistaken for solid ovarian masses. Careful search for and identification

of normal ovaries that may be displaced by uterine myomas and blood supply from uterine vessels help avoid this error [29].

Solid ovarian masses include benign ovarian tumors such as mature teratomas, fibromas, thecomas, Brenner tumors, and malignant ovarian tumors (primary and metastatic), chronic ectopic pregnancy, and a chronically torsed ovary. The most common ovarian neoplasm in women of reproductive age is a benign cystic teratoma, which has a broad spectrum of US appearances and can be diagnosed correctly by US in most cases. Most fibrothecoma tumors can be diagnosed on US by the presence of hypoechoic attenuating component [29]. Most malignant ovarian masses can be diagnosed by US or MRI when there is enhancing solid components or enhancing mural nodules or papillary projections [5]; however, typically in pregnancy, the use of IV contrast for MR is avoided, thus increasing the reliance on US to demonstrate vascularity in solid elements.

Indeterminate Masses

Masses without the specific features mentioned above are considered indeterminate [7]. A simple cyst or unilocular cyst has no or very small chance of becoming malignant (<0.4%) [32]. A single thin septation <3 mm is considered benign [32]. Multiple septations without papillary projections or solid components are unlikely to be malignant [32]. Cysts with one or a few small papillary projections that are <3 mm are likely to be benign [32]. A number of sonographic predictors have been designed to reduce the number of unnecessary surgeries and triage patients with high risk of malignancy to the gynecology oncologists and patients with low-risk masses to the general gynecologist. The IOTA group Simple Rules appear to perform better than RMI and are equal to the logistic regression of IOTA rules [2] to predict risk of malignancy [33]. Utilization of IOTA Simple Rules resulted in a sensitivity and specificity, respectively, of 0.93 [95% CI: 0.89–0.95] and 0.81 [95% CI: 0.76–0.85].

IOTA Simple Rules include 10 features; 5 of them (B features) are used to predict a benign adnexal mass and the other 5 (M features) are used to predict a malignant mass. B features include unilocular cyst, solid components present but that are <7 mm, acoustic shadows, smooth multilocular tumor, largest diameter <100 mm, and no blood flow. Malignant features include irregular solid tumor, ascites, at least 4 papillary structures, irregular multilocular-solid tumor, largest diameter 100 mm, and very strong flow [33].

Referral to a sonologist with a particular interest in adnexal masses in pregnancy can be of value if the original assessment via US was indeterminate.

Color, Power, and Spectral Doppler US Pelvis

Color or power Doppler should be included in the US examination of the female pelvis. The use of color or power Doppler adds significant contributions to differentiating between benign and malignant masses by differentiating a true solid component from a solid-appearing component or debris within a cyst. In addition, color or power Doppler can help confirm that the origin of an adnexal mass is from the uterus rather than the ovary by the presence of a bridging-vessel sign and is recommended as an integral part of the US examination, especially for indeterminate masses [34,35]. Malignant masses generally demonstrate neovascularity. More recent studies have established that spectral Doppler US parameters (resistive index, pulsatility index, peak systolic velocity, time-averaged V_{max}) do not provide any significant improvement over morphologic assessment; therefore, the value of spectral Doppler analysis is limited [36,37]. However, spectral Doppler is useful to differentiate motion-related changes on color or power Doppler from true flow. Hence, color or power Doppler is indicated in the assessment of any indeterminate or solid adnexal mass. 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 [23,36,37]. Assessment of papillary projections or solid tumor areas with 3-D power Doppler may be helpful in reducing the false-negative rate of benign indeterminate cystic adnexal masses [38]. In one series in which 3-D power Doppler was added to the RMI, the sensitivity for the prediction of malignancy increased from 88% to 99% [39]. However, 3-D US is not considered a requirement in US evaluation of adnexal mass, considering the paucity of available literature.

The combination of color Doppler with serum CA-125 has been proposed to increase sensitivity for differentiating benign from malignant ovarian tumors [40]. In 2 studies when increasing the cut-off point of serum CA-125 from 35 U/mL to 65 U/mL in the presence of resistive index <0.5, the best specificity (100%) and positive predictive value (100%) were reached [41,42]. However, it is important to note that while the majority of malignant ovarian tumors were correctly classified using US, CA-125 alone performed worse than US in distinguishing benign from malignant lesions considering it may be low with low-grade and low malignant potential lesions. In fact, CA-125 levels improved the specificity of diagnosing a malignant ovarian tumor only in

those lesions already suspected to be malignant on US [43]. US imaging features, such as hydronephrosis, ascites, pleural effusions, and liver, peritoneal, or omental metastases, are important in the evaluation of the extent of disease. Moreover, CA-125 values are higher during pregnancy and, because of the wide fluctuations in the levels in very early pregnancy and the immediate postpartum period, CA-125 levels are not useful for clinical correlation with the pathologic conditions during this period [57].

US Pelvis Transabdominal

Transabdominal US should be included in the US examination of the female pelvis. It is especially helpful in the presence of a large mass that is not optimally assessed on the transvaginal US.

Adnexal masses with benign features that are optimally seen on US can be followed by US. Functional cysts with typical features measuring <5 cm do not require follow-up. Atypical or larger functional cysts, categorized as indeterminate, can be followed up by US. Change in the appearance and size of the cyst on follow-up help differentiation from a pathological adnexal mass. Typically, functional hemorrhagic cysts will resolve, whereas nonfunctional masses will persist. Most nonfunctional cysts in pregnant women with benign features measuring <6 cm in diameter have been shown to remain unchanged during long-term follow-up. Therefore, it is possible to manage these lesions safely by US follow-up rather than surgical intervention in asymptomatic women [53]. Endometriotic cysts are followed up because of the small risk (<1%) of malignant transformation [54]. Other benign lesions, such as dermoid and fibromas, that are not operated on can also be followed by US.

US can be performed to follow an adnexal mass following a diagnosis of a mass highly suspicious for malignancy (low malignant potential or invasive cancer) if pregnancy is not terminated.

MRI Pelvis

MRI without IV contrast can be performed as a problem solver to further assess a finding that would require further characterization following US.

In a retrospective study, the sensitivity and specificity of MRI was 100% (95% CI: 70.1%–100%) for 2 independent readers and 85.1% (95% CI: 67.5%–94%) and 77.7% (95% CI: 59.2%–89.4%) for reader one and reader two, respectively. No malignancy was classified as benign using MR criteria. The reproducibility between the 2 readers was almost perfect, with a kappa of 0.914 [58].

MRI without IV contrast can be performed to follow large benign masses that cannot be optimally visualized by US or masses with unexplained change of appearance during US follow-up.

CT Pelvis

CT is usually not indicated for the workup and characterization of adnexal masses during pregnancy because of its relatively limited ability to characterize adnexal masses.

CT is not indicated to follow known benign adnexal masses during pregnancy.

CT with IV contrast (if feasible) is the main modality to follow patients with known adnexal origin malignancy, if pregnancy is terminated, both to determine response to treatment and to exclude recurrence.

FDG-PET/CT

FDG-PET/CT may play a role in women with a known history of malignancy who present for evaluation of an adnexal mass to identify other sites of disease [20], if pregnancy is terminated.

Summary of Recommendations

- **Variation 1:** US duplex Doppler pelvis, US pelvis transvaginal, and US pelvis transabdominal are usually appropriate for the initial imaging of premenopausal patients with a clinically suspected adnexal mass and no acute symptoms. These procedures are complementary (ie, all tests should be performed).
- **Variation 2:** US duplex Doppler pelvis, US pelvis transvaginal, and US pelvis transabdominal are usually appropriate for the initial imaging of postmenopausal patients with a clinically suspected adnexal mass and no acute symptoms. These procedures are complementary (ie, all tests should be performed).
- **Variation 3:** US duplex Doppler pelvis, US pelvis transvaginal, and US pelvis transabdominal are usually appropriate for the initial follow-up of premenopausal patients with a likely benign adnexal mass and no acute symptoms. These procedures are complementary (ie, all tests should be performed).

- **Variation 4:** US duplex Doppler pelvis, US pelvis transvaginal, and US pelvis transabdominal are usually appropriate for the initial follow-up of postmenopausal patients with a likely benign adnexal mass and no acute symptoms. These procedures are complementary (ie, all tests should be performed).
- **Variation 5:** US pelvis transvaginal, US duplex Doppler pelvis, US pelvis transabdominal, and MRI pelvis without and with IV contrast are usually appropriate for the initial follow-up of premenopausal patients with indeterminate adnexal mass and no acute symptoms. These procedures are complementary (ie, all tests should be performed).
- **Variation 6:** US pelvis transvaginal, US duplex Doppler pelvis, US pelvis transabdominal, and MRI pelvis without and with IV contrast are usually appropriate for the initial follow-up of postmenopausal patients with an indeterminate adnexal mass and no acute symptoms. These procedures are complementary (ie, all tests should be performed).The panel did not agree on recommending CT pelvis without and with IV contrast in postmenopausal patients with this condition. There is insufficient medical literature to conclude whether or not these patients would benefit from this procedure. CT pelvis without and with IV contrast in this patient population is controversial but may be appropriate.
- **Variation 7:** CT abdomen and pelvis with IV contrast and MRI pelvis without and with IV contrast are usually appropriate for the initial follow-up of patients with an adnexal mass, highly suspicious for malignancy, and no acute symptoms. These procedures are complementary (ie, all tests should be performed). The panel did not agree on recommending CT pelvis with IV contrast, CT pelvis without and with IV contrast, and US duplex Doppler pelvis in patients with an adnexal mass that is highly suspicious for malignancy and no acute symptoms. There is insufficient medical literature to conclude whether or not these patients would benefit from these procedures. Performing these procedures in this patient population is controversial but may be appropriate.
- **Variation 8:** US duplex Doppler pelvis, US pelvis transabdominal, and US pelvis transvaginal are usually appropriate in the initial imaging and follow-up of pregnant patients with a clinically suspected adnexal mass and no acute symptoms. These procedures are complementary (ie, all tests should be performed).

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.

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 \(MRI\)](#) [59]
- [ACR-SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation](#) [60]
- [ACR-ACOG-AIUM-SRU Practice Parameter for the Performance of Obstetrical Ultrasound](#) [61]
- [ACR Manual on Contrast Media](#) [19]
- [ACR Guidance Document for MR Safe Practices](#) [62]

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 [63].

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.