American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: **Clinically Suspected Adnexal Mass**

Variant 1: **Reproductive age female (not pregnant). Initial evaluation.**

Radiologic Procedure	Rating	Comments	RRL*
US pelvis transvaginal	9	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances.	O
US duplex Doppler pelvis	9	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances. Color or power US is recommended, less so spectral Doppler.	O
US pelvis transabdominal	8	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances.	O
MRI pelvis without and with IV contrast	6		O
MRI pelvis without IV contrast	5		O
CT pelvis without IV contrast	2		☢☢☢
CT pelvis with IV contrast	2		☢☢☢
CT pelvis without and with IV contrast	2		☢☢☢☢
Image-guided aspiration or biopsy adnexal mass	2		Varies
FDG-PET/CT whole body	1		☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Clinical Condition: **Clinically Suspected Adnexal Mass**

Variant 2: **Reproductive age female (not pregnant) with complex or solid mass detected by pelvic sonography. Follow-up recommendations.**

Radiologic Procedure	Rating	Comments	RRL*
US pelvis transvaginal	9	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances.	O
US duplex Doppler pelvis	9	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances. Color or power US is recommended, less so spectral Doppler.	O
US pelvis transabdominal	8	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances.	O
MRI pelvis without and with IV contrast	5		O
MRI pelvis without IV contrast	4		O
CT pelvis with IV contrast	3		☢☢☢
CT pelvis without IV contrast	2		☢☢☢
CT pelvis without and with IV contrast	2		☢☢☢☢
FDG-PET/CT whole body	2		☢☢☢☢
Image-guided aspiration or biopsy adnexal mass	2		Varies
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Clinical Condition: **Clinically Suspected Adnexal Mass**

Variant 3: **Reproductive age female (not pregnant) with complex or solid mass detected by pelvic sonography getting smaller at short-term follow-up. (If resolved, no further imaging necessary.)**

Radiologic Procedure	Rating	Comments	RRL*
US pelvis transvaginal	9	Either TAS and/or TVS may be tailored as appropriate to visualize the lesion.	O
US duplex Doppler pelvis	9	With either TAS or TVS to exclude vascular flow. Color or power US is recommended, less so spectral Doppler.	O
US pelvis transabdominal	8	Either TAS and/or TVS may be tailored as appropriate to visualize the lesion.	O
MRI pelvis without IV contrast	3		O
MRI pelvis without and with IV contrast	3	May be useful for endometriosis and associated scarring.	O
CT pelvis without IV contrast	1		☢☢☢
CT pelvis with IV contrast	1		☢☢☢
CT pelvis without and with IV contrast	1		☢☢☢☢
FDG-PET/CT whole body	1		☢☢☢☢
Image-guided aspiration or biopsy adnexal mass	1		Varies
Rating Scale: **1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate**			***Relative Radiation Level**

Clinical Condition: **Clinically Suspected Adnexal Mass**

Variant 4: **Reproductive age female (not pregnant) with indeterminate complex or solid mass that is persistent or enlarging on pelvic sonography at short-term follow-up. (In the appropriate clinical setting, surgery may be performed in lieu of additional imaging.)**

Radiologic Procedure	Rating	Comments	RRL*
MRI pelvis without and with IV contrast	8		O
MRI pelvis without IV contrast	6	If patient is unable to tolerate contrast.	O
US pelvis transvaginal	5		O
US pelvis transabdominal	5		O
US duplex Doppler pelvis	5		O
CT pelvis with IV contrast	4	If patient cannot get MRI.	☢☢☢
CT pelvis without IV contrast	2		☢☢☢
CT pelvis without and with IV contrast	2		☢☢☢☢
FDG-PET/CT whole body	2	Not appropriate for tissue characterization of adnexal lesions. For ovarian cancer staging, see the ACR Appropriateness Criteria® topic on "Staging and Follow-up of Ovarian Cancer."	☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Clinical Condition: **Clinically Suspected Adnexal Mass**

Variant 5: **Reproductive age female (not pregnant). Initial sonography demonstrates a large and apparently simple cyst >5 cm in diameter.**

Radiologic Procedure	Rating	Comments	RRL*
US pelvis transvaginal	9	Either TAS and/or TVS may be tailored as appropriate to visualize the lesion. If it is >5 cm, but ≤7 cm annual follow-up is recommended.	O
US duplex Doppler pelvis	9	With either TAS or TVS to exclude vascular flow.	O
US pelvis transabdominal	8	Either TAS and/or TVS may be tailored as appropriate to visualize the lesion. If it is >5 cm, but ≤7 cm annual follow-up is recommended.	O
MRI pelvis without and with IV contrast	4	MRI may be useful if the cyst is indeterminate on US or inadequately evaluated due to technical limitations.	O
MRI pelvis without IV contrast	3		O
CT pelvis with IV contrast	2		☢☢☢
Image-guided aspiration or biopsy adnexal mass	2	Not appropriate for diagnosis, unless infectious etiology is suspected. May be used as a therapeutic tool.	Varies
CT pelvis without IV contrast	1		☢☢☢
CT pelvis without and with IV contrast	1		☢☢☢☢
FDG-PET/CT whole body	1		☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Clinical Condition: **Clinically Suspected Adnexal Mass**

Variant 6: **Postmenopausal female (>12 months amenorrhea). Initial evaluation.**

Radiologic Procedure	Rating	Comments	RRL*
US pelvis transvaginal	9	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances.	O
US duplex Doppler pelvis	9	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances. Color or power US is recommended, less so spectral Doppler.	O
US pelvis transabdominal	8	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances.	O
MRI pelvis without and with IV contrast	5		O
MRI pelvis without IV contrast	4		O
CT pelvis without IV contrast	2		☢☢☢
CT pelvis with IV contrast	2		☢☢☢
FDG-PET/CT whole body	2		☢☢☢☢
CT pelvis without and with IV contrast	1		☢☢☢☢
Image-guided aspiration or biopsy adnexal mass	1		Varies
Rating Scale: **1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate**			***Relative Radiation Level**

Clinical Condition: **Clinically Suspected Adnexal Mass**

Variant 7: **Postmenopausal female (>12 months amenorrhea) with a simple ovarian cyst >1 cm in diameter by pelvic sonography. Follow-up recommendations. (See narrative for information regarding serum CA-125.)**

Radiologic Procedure	Rating	Comments	RRL*
US pelvis transvaginal	9	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances. Use of annual follow-up to ensure cyst is stable, but if it is >7 cm consider MRI.	O
US duplex Doppler pelvis	9	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances.	O
US pelvis transabdominal	8	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances. Use of annual follow-up to ensure cyst is stable, but if it is >7 cm consider MRI.	O
MRI pelvis without and with IV contrast	3	Generally only considered for simple cysts >7 cm.	O
MRI pelvis without IV contrast	2		O
CT pelvis without IV contrast	2		☢☢☢
CT pelvis with IV contrast	2		☢☢☢
FDG-PET/CT whole body	2		☢☢☢☢
CT pelvis without and with IV contrast	1		☢☢☢☢
Image-guided aspiration or biopsy adnexal mass	1		Varies
Rating Scale: **1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate**			***Relative Radiation Level**

Clinical Condition: **Clinically Suspected Adnexal Mass**

Variant 8: **Postmenopausal female (>12 months amenorrhea) with a complex or solid adnexal mass seen by pelvic sonography. Follow-up recommendations. (See narrative for information regarding serum CA-125.) (In the appropriate clinical setting, surgery may be performed in lieu of additional imaging.)**

Radiologic Procedure	Rating	Comments	RRL*
US pelvis transvaginal	9	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances.	O
US pelvis transabdominal	9	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances.	O
US duplex Doppler pelvis	9	All three tests (TVS, TAS, and Doppler) may be performed depending on the clinical circumstances. Color or power US is recommended, less so spectral Doppler.	O
MRI pelvis without and with IV contrast	6		O
MRI pelvis without IV contrast	5		O
CT pelvis without and with IV contrast	3		☢☢☢☢
FDG-PET/CT whole body	3	May be useful in patients with known primary malignancy outside the ovary.	☢☢☢☢
CT pelvis with IV contrast	2		☢☢☢
CT pelvis without IV contrast	1		☢☢☢
Image-guided aspiration or biopsy adnexal mass	1		Varies
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

CLINICALLY SUSPECTED ADNEXAL MASS

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Summary of Literature Review

Introduction/Background

Adnexal masses are a common problem clinically, and pelvic sonography (US), specifically endovaginal US, is the first-line imaging modality for assessing them. Its findings, however, should be correlated with the history and laboratory tests. Morphological analysis of adnexal masses with US can help narrow the differential diagnosis. Recent studies have shown that US (transvaginal plus color Doppler) may discriminate benign from malignant lesions with a sensitivity of 99.1 % and a specificity of 85.9% [1]. However, US is not always reliable for triage of patients to surgery [2].

Transabdominal sonography (TAS) and transvaginal sonography (TVS) are complementary. In some facilities, patients are scanned by both techniques, but most recent literature regarding adnexal mass US refers to TVS.

Transvaginal Ultrasound

The applications of TVS in evaluating adnexal masses have been well described [3,4]. Because of the improved resolution of TVS, it should be used whenever possible. When an adnexal mass is large or beyond the field of view of TVS, TAS is recommended. TAS will often provide an overview of the relationship of the mass to other pelvic structures.

The improved resolution of high-frequency endoluminal transducers along with the judicious use of color Doppler interrogation increases the sensitivity for identifying malignant adnexal masses to 92%-99% [5,6]. TVS can be used not only to differentiate between cystic and solid masses but also to improve characterization and detect vascularity of the wall or internal septations, similar features of mural nodules, and the echogenicity of cystic and complex ovarian masses. The specificity of TVS for diagnosing ovarian cancer has been reported as high as 92%-97% [5,7,8]. TVS can help determine the origin of an adnexal mass. When evaluating a pelvic mass, it is important to determine its origin as ovarian or extraovarian. Masses arising from the ovary can be separated from extraovarian masses by identifying a rim of compressed ovarian parenchyma around the mass. Masses arising from the fallopian tube are usually seen as distended, tubular structures that arise from the superolateral aspect of the uterus [9]. Masses arising from the uterus are usually solid and connected to the uterus by a vascular pedicle. Using TVS, attachment of a mass to the ovary or to the uterus can often be determined, using the sliding organ sign (real-time motion of a mass against adjacent organs during extrinsic pressure while using the transvaginal probe [10]).

TVS can help in characterizing a mass sonographically as cystic, solid, or complex. Cystic masses are usually ovarian or tubal. A simple cyst is associated with five features: 1) round shape, 2) thin or imperceptible wall, 3) increased acoustic enhancement, 4) anechoic fluid, and 5) no septations or nodules.

In addition, TVS or TAS with color, power, and spectral Doppler can be used to assess the vascularity of a mass and provide a guide for aspiration of certain masses suspected to be infectious in origin. Aspiration is generally

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not performed for determining neoplastic cytologic origin due to the concern for spreading malignant cells into the peritoneum.

Simple Cyst

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 and in 95-99% of postmenopausal women [11,12]. A recent consensus conference at the Society of Radiologists in Ultrasound in 2009 reviewed the management of asymptomatic ovarian and other adnexal cysts. [4]. Most cysts in premenopausal women are functional in nature and will resolve spontaneously. Most nonfunctional cysts in premenopausal women with classically complex, but benign, US features (such as endometriomas, simple cysts, teratomas, and hydrosalpinges) measuring <5 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 [13].

In postmenopausal women, simple cysts are seen with a frequency of 17%-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 [14]. These cysts may disappear (53%), not change (28%), enlarge (11%), decrease (3%), or increase and decrease (6%) [15]. Adnexal cysts ≤5 cm in postmenopausal women are rarely malignant [4,11]. . TVS aspiration of adnexal cysts should be performed only when there is strong evidence of a benign etiology in order to avoid potential complications such as peritoneal contamination by ovarian cancer cells or pseudomyxoma peritonei [16]. TVS aspiration plays an important role in the diagnosis and treatment of tubovarian abscesses (TOAs) [17]. It may also be performed for symptomatic relief in cases of large peritoneal inclusion cysts or benign ovarian cysts [18,19].

Solid or Complex Masses

Most solid adnexal masses are pedunculated leiomyomas (or “myomas” or “fibroids”). Leiomyomas are the most common uterine neoplasms, and are prevalent in approximately 20%-30% of women older than age 30 [20]. 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 helps avoid this error.

Solid ovarian masses include benign ovarian tumors such as some teratomas, fibromas, thecomas, malignant ovarian tumors (primary and metastatic), and a 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. When the diagnosis is in doubt, computed tomography (CT) or magnetic resonance imaging (MRI) can depict the fatty elements, teeth (7%), or bony fragments (18%) characteristic of these lesions. Most solid ovarian masses are removed surgically. Even benign solid masses, if large, present a risk of torsion. The risk of malignant degeneration in cystic teratomas is rare, reported as <1% [21].

Complex adnexal masses are usually ovarian in origin. In women of reproductive age these most commonly present as hemorrhagic cysts or endometriomas. The sonographic characteristics suggest the diagnosis, and a follow-up US can be done after two or three menstrual cycles to evaluate for resolution. The optimal time for this follow-up evaluation is within the first 7-10 days after the onset of menses in order to avoid confusion with a new hemorrhagic cyst. Typically hemorrhagic cysts will resolve, whereas endometriomas will persist. When atypical features are present, MRI can be useful to confirm the presence of endometriosis. In the appropriate clinical setting, TOAs, ectopic pregnancies, and adnexal torsion can present as complex masses. Therefore, a pregnancy test is important to narrow the differential diagnosis.

Even though US may distinguish malignant from benign neoplasms, it provides useful information. Various authors have devised morphologic scoring systems for pelvic masses to predict ovarian malignancy based on size, internal borders, and the presence of septa, papillary projections, and echogenicity [5,6,22,23]. The presence of mural nodules or septations (especially with color Doppler flow) suggests that an adnexal mass is a neoplasm. Three-dimensional US morphologic assessment does not appear to improve the diagnosis of complex adnexal masses [24]; however, the combination of three-dimensional US and three-dimensional color and duplex Doppler may contribute to the differentiation between benign and malignant masses because it improves detection of central blood vessels, which are more common in malignant lesions [25,26].

Color and Duplex Doppler

More recent studies have established that spectral Doppler US parameters (resistive index, pulsatility index, peak systolic velocity, time-averaged Vmax) do not provide any significant improvement over morphologic assessment; therefore, the value of spectral Doppler analysis is very limited [27,28]. However, the use of color Doppler adds significant contributions to differentiating between benign and malignant masses and is recommended in all cases of complex masses [29,30]. Malignant masses generally demonstrate neovascularity, with abnormal branching patterns or vessel morphology. Hence, color Doppler is indicated in the assessment of any complex or solid adnexal mass. Optimal sonographic evaluation is achieved by using a combination of gray-scale morphologic assessment and color or power Doppler imaging to detect flow within any solid areas [27,28,31]. Three dimensional power Doppler assessment of papillary projections or solid tumor areas may be helpful in reducing the false positive rate of benign complex cystic adnexal masses [32]. Another recent study showed that 3D power Doppler increased the sensitivity rate from 88% to 99% with the Risk of Malignancy Index (based on menopausal status, serum CA-125, and US findings) [26].

The combination of color Doppler with serum CA-125 has been proposed to increase sensitivity for differentiating benign from malignant ovarian tumors [33]. When increasing the cutoff 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 [34,35]. US imaging features such as hydronephrosis, ascites, pleural effusions, and liver, peritoneal, or omental metastases are important in evaluation of the extent of disease.

Magnetic Resonance Imaging

MRI can be used to determine the origin of a mass (uterine versus ovarian) and help distinguish benign from malignant masses with an overall accuracy for the diagnosis of malignancy of 91%. On MRI, identification of 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 gray-scale US found that contrast-enhanced MRI contributed to a greater probability of ovarian cancer than CT, Doppler US, or MRI without contrast [36]. In addition, MRI increases confidence in the diagnosis of mature cystic teratoma and leiomyoma [37]. MRI is valuable for characterizing indeterminate adnexal masses seen on US, with a sensitivity for identifying malignancy of 100% and a specificity for benignity of 94%, in one small series [38]. In a prospective study of women with suspected adnexal masses, both US with Doppler and MRI were highly sensitive for characterizing lesions as malignant (US 100%, MRI 96.6%), but the specificity of MRI was significantly greater (US 39.5%, MRI 83.7%). Therefore, women who clinically have a low risk of malignancy but have complex lesions on US are the patients who will most likely benefit from contrast-enhanced MRI [36]. More recent work states that the addition of diffusion- and perfusion-weighted MRI improved accuracy, compared to conventional MRI alone, with an accuracy rate of 95% with the combined technique [39,40].

Computed Tomography

CT is usually not indicated for the differential diagnosis of adnexal masses because of its poor soft-tissue discrimination, except when identification of characteristic calcifications (such as teeth in a teratoma) or macroscopic fat is important to make the diagnosis [41]. If the adnexal mass is thought to be malignant, CT may be indicated to stage a suspected primary ovarian cancer (see the ACR Appropriateness Criteria® topic on "Staging and Follow-up of Ovarian Cancer") or to identify the primary intra-abdominal cancer (eg, colon, gastric, pancreatic) with suspected ovarian metastases. Furthermore, CT involves ionizing radiation exposure, which has recently become much more of a concern in the scientific and lay literature for future cancer risks, and the principle of ALARA (as low as reasonably achievable) radiation dosing should be of paramount importance. With US and MRI well established, there is little reason presently to obtain a CT for adnexal pathology other than for cancer staging.

Positron Emission Tomography

The sensitivity and specificity of positron emission tomography (PET) 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 [42]. A small series of 18 patients showed that F18-FDG coincidence PET was of clinical value when assessing suspicious malignant adnexal masses. However, borderline (low malignant potential) tumors or leiomyomas can cause false-positive results with this technique [43].

Summary

- US remains the study of choice for evaluating a woman with a clinically suspected adnexal mass.
- Color or power Doppler US is an essential adjunct to gray-scale imaging. Spectral Doppler US has not been reliable or accurate in differentiating benign from malignant adnexal masses.
- US remains the most important modality for follow-up of adnexal masses.
- MRI is a valuable problem-solving tool when US is inconclusive or limited due to body habitus. Recent evidence supports the implementation of diffusion- or perfusion-weighted imaging in addition to conventional MR pulse sequences.
- To a lesser extent, CT is useful in selected cases when a nongynecologic origin of an adnexal mass is suspected. Despite its expediency, CT should not be used in most cases as the primary imaging tool because of its nonspecificity and its use of ionizing radiation.

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, both because of 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 to 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.

Relative Radiation Level Designations		
Relative Radiation Level*	**Adult Effective Dose Estimate Range**	**Pediatric Effective Dose Estimate Range**
O	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".		

Supporting Documents

For additional information on the Appropriateness Criteria methodology and other supporting documents go to www.acr.org/ac.

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