

American College of Radiology ACR Appropriateness Criteria®

Clinical Condition: Staging and Follow-up of Ovarian Cancer

Variant 1: Pretreatment staging of ovarian cancer. (See narrative for comments regarding CA-125.)

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and pelvis with contrast	9		☼☼☼☼
MRI abdomen and pelvis with contrast	5	Evidence shows equivalent staging accuracy compared to CT. Problem-solving modality for patients who cannot have contrast-enhanced CT. See statement regarding contrast in text under “Anticipated Exceptions.”	O
US pelvis transvaginal	5	Evidence shows equivalent staging accuracy compared to CT and MRI, but scan time and coverage may limit efficiency.	O
CT chest with contrast	4	For abnormal chest x-ray, including pleural effusions, supraclavicular adenopathy.	☼☼☼
X-ray contrast enema	3		☼☼☼
X-ray intravenous urography	2		☼☼☼
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

Variant 2: Rule out recurrent ovarian cancer. (See narrative for comments regarding CA-125.)

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and pelvis with contrast	9		☼☼☼☼
CT chest abdomen and pelvis with contrast	9	Indicated if abnormal chest x-ray, known extensive abdominal disease, or markedly elevated CA-125, or preoperatively for debulking to insure disease is limited to the abdomen.	☼☼☼☼
FDG-PET whole body with concurrent diagnostic CT abdomen and pelvis with contrast	9	If available, useful in patients with clinically suspected recurrence and a negative CT and for pretreatment planning in patients with oligometastatic disease on CT.	☼☼☼☼
MRI abdomen and pelvis with contrast	5	Problem-solving modality. Appropriate for patients who cannot have contrast-enhanced CT. See statement regarding contrast in text under “Anticipated Exceptions.”	O
US pelvis transvaginal	4	May be used as problem-solving tool for disease in the pelvis.	O
FDG-PET whole body without concurrent diagnostic CT	4	Limited due to difficulties in spatial localization, especially in the abdomen.	☼☼☼☼
X-ray contrast enema	3		☼☼☼
X-ray intravenous urography	2		☼☼☼
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

STAGING AND FOLLOW-UP OF OVARIAN CANCER

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Summary of Literature Review

Introduction/Background

Ovarian cancer is the fifth most common cause of cancer death in women in the United States behind lung, breast, colorectal, and pancreatic cancers, accounting for more than 3% of all cancers in women and causing more deaths than any other gynecologic malignancy [1]. Most ovarian cancer typically presents late, stage III-IV, after the disease has spread widely out of the pelvis [2]. The roles of diagnostic imaging have been to characterize the ovarian mass, determine the extent of preoperative disease, and predict tumor resectability [3-6]. Surgical staging is both diagnostic and therapeutic, and an experienced gynecologic surgeon is critical in optimum debulking of this tumor. However, up to 40% of patients may be understaged at laparotomy [7].

Overview of Imaging Modalities

Transvaginal ultrasound (US) has a role in ovarian cancer screening and in characterizing ovarian masses as benign or malignant. It can be used to determine the site of origin of a pelvic mass and to characterize the lesion [8]. A combination of morphology and Doppler waveform analysis may provide the most accurate risk assessment for an adnexal lesion by US [4,9,10].

The proper choice of treatment for ovarian cancer depends on accurate staging. Computed tomography (CT) and magnetic resonance imaging (MRI) have been used to determine the resectability of tumors, the candidacy of patients for effective cytoreductive surgery, the need for

preoperative chemotherapy if debulking is suboptimal, and the need for referral to a gynecologic oncologist [11-16]. Limited disease means stage I or II. Regional disease means stage II, involving one or both ovaries with pelvic extension. Advanced disease means stages III and IV [4,6,17].

Cytoreductive surgery is the standard treatment for ovarian cancer. Imaging is used to define the extent of disease, assess the likelihood of optimal primary cytoreduction [7], and select patients who may benefit from neoadjuvant chemotherapy [18,19]. Standard radiographic techniques such as chest radiograph, barium enema, and excretory urography have been replaced in many countries, including the United States, by cross-sectional imaging, especially CT, for ovarian cancer staging [20-23].

Computed Tomography

CT is the imaging modality of choice in the preoperative evaluation of ovarian cancer and has been validated as an accurate method to predict successful surgical cytoreduction. CT has been useful for detecting local tumor involvement of the pelvic ureter and uterine serosa, as well as metastases to the peritoneum, omentum, mesentery, liver, spleen, and lymph nodes [21]. CT has a reported accuracy for ovarian cancer staging of up to 94% [7]. Current high-resolution multidetector CT scanners can detect peritoneal implants as small as 5 mm (specificity 100%, and accuracy 80% for all sites except the diaphragm and pelvis), and they reduced the false-negative rate (which is up to 50% for helical CT) when using multiplanar reconstruction for optimal depiction of disease [13]. The most important limitation of CT in staging ovarian cancer is its inability to reliably detect bowel surface, mesenteric, or peritoneal tumor implants <5 mm, especially in the absence of ascites [11,14,24].

Magnetic Resonance Imaging

MRI is an excellent problem-solving technique by virtue of its ability to define common conditions such as fibroids, dermoid cysts, endometriomas, and other benign lesions [6]. Two studies found no statistical difference between CT and MRI in defining disease extent [12,16]. A multivariate analysis showed that the accuracy of MRI with gadolinium enhancement in diagnosing ovarian malignancy was 93% [25]. Gadolinium enhancement improved diagnostic confidence and tissue characterization [25]. However, the role of MRI has been limited because 1) the use of intraluminal gastrointestinal contrast agents with MRI is not as routine as it is with CT, 2) MRI generally costs more than CT, and 3) there are fewer experienced radiologists to interpret MRI. Thus, CT is currently the recommended modality for staging ovarian cancer. MRI is recommended for patients with a contraindication to the use of iodinated contrast agents (allergy, renal insufficiency), patients who are pregnant, and those for whom CT findings are inconclusive [26-28]. Higher-field MRI scans may improve the accuracy of

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MRI for staging of ovarian cancer pending further investigation [29].

Predicting Resectability

For predicting the nonresectability of ovarian cancer, cross-sectional imaging (CT or MRI) plays a critically important role in finding significant lesions (>2 cm) at the root of the mesentery, gastrosplenic ligament, omentum of the lesser sac, portahepatic, intersegmental fissure of the liver, diaphragm, and liver dome, and also in detecting lymphadenopathy at or above the celiac axis, presacral extraperitoneal disease, and pelvic sidewall invasion [7,21,30-33]. Unresectable disease can be managed by needle or laparoscopic biopsy, chemotherapy, and possibly a later attempt at optimal debulking, resulting in improved survival by virtue of optimal response to chemotherapy [27].

Positron Emission Tomography

The use of fluorine-18-2-fluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET) imaging in the primary diagnosis and tissue characterization of ovarian cancer is unsupported to date. Specificity has been reported as low as 54% and moderate sensitivity as high as 86% [27,34-36]. Also, false-negative results have been reported with borderline tumors, early carcinomas, and adenocarcinomas. False-positive results have been reported with dermoid cysts, hydrosalpinges, and endometriosis [27,35].

However, FDG-PET, especially when combined with CT, is a valuable tool for diagnosing advanced disease and detecting recurrent tumor [37-39]. The use of FDG-PET combined with serum tumor marker CA-125 has had a reported sensitivity as high as 98% [40], and PET alone has a sensitivity of 85% [40,41]. In detecting recurrence, best performances have been reported with fusion PET/CT, with a sensitivity of 95%-97% and specificity of 80%-100% [42,43]. Second-look laparotomy is no longer routinely performed. The noninvasive diagnosis of recurrence obviates the need for unnecessary surgery.

Recurrent Disease

Imaging plays a key role in detecting recurrence and the pattern of disease which will determine the treatment choice among surgery, chemotherapy, and radiation therapy. MRI and CT are roughly equivalent for identifying lesions >2 cm [7]. CT is 58% sensitive and 100% specific in predicting unsuccessful debulking [21]. The reported accuracy of MRI for detecting lesions >2 cm is comparable to that of CT at 93%-95% [7]. Fusion PET/CT has been reported to be more sensitive than CT alone in detecting recurrence [42] and is particularly useful in a patient with clinically suspected recurrence and a negative CT or for planning local therapy in patients with suspected oligometastatic disease on CT [43]. CT remains the most widely used imaging method for detecting recurrence for the same reasons as those that are discussed above for primary staging.

CA-125 Levels

The preoperative evaluation of patients with suspected ovarian carcinoma usually includes a serum CA-125 determination. Only about 50% of all patients with stage I ovarian cancer have a true-positive result [4,36]. Thus, this test alone is inadequate when used in isolation as a screening tool. This is especially true in menstruating females, since false-positive results have been reported with endometriosis, benign ovarian cysts, pregnancy, and pelvic inflammatory disease. However, with stage II or greater ovarian cancer, the true positive rate is as high as 80% [44]. There is a very high correlation between CA-125 levels and the clinical course of the patient during chemotherapy. Pancreatic cancer and cirrhosis have caused elevated CA-125 levels. CA-125 levels can also predict tumor recurrence among patients who are clinically tumor free [40].

Anticipated Exceptions

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (ie, <30 mL/min/1.73m²), and almost never in other patients. There is growing literature regarding NSF. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates <30 mL/min/1.73m². For more information, please see the [ACR Manual on Contrast Media](#) [45].

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 NS (not specified).

Supporting Document(s)

- [ACR Appropriateness Criteria® Overview](#)
- [Procedure Contrast Information](#)
- [Evidence Table](#)

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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.