

The Role of Computed Tomography and Magnetic Resonance Imaging in Gynecologic Oncology

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KEYWORDS

- Gynecology • Malignancy • Computed tomography (CT) • Magnetic resonance (MR)
- International federation of gynecology and obstetrics (FIGO) classification system
- Endometrial • Cervical • Ovarian

KEY POINTS

- Gynecologic malignancies are staged by clinical, surgical, or histopathological criteria. The most current staging systems for the various gynecologic cancers are reviewed. This includes the new classification of extrauterine pelvic serous carcinoma, postulated to develop from serous tubal intraepithelial carcinomas.
- CT and MR imaging play a crucial role in the preoperative evaluation of the disease and surveillance of patient undergoing treatment. Strengths and weaknesses of CT and MR imaging for staging and monitoring therapy are discussed for the various gynecologic malignancies.
- Accuracy of disease staging is crucial, because this dictates treatment options, including surgical resection, chemotherapy, and/or radiation therapy.

IMAGING RECOMMENDATIONS AND GUIDELINES

Gynecologic malignancies are predominately staged by clinical, surgical, or histopathologic criteria. The American College of Radiology (ACR), National Comprehensive Cancer Network (NCCN), and International Federation of Gynecology and Obstetrics (FIGO) provide recommendations and guidelines on the role of imaging in gynecologic malignancies. CT and MR imaging also play critical roles in patient evaluation and surveillance.

Malignancy may initially be detected at CT for vague symptoms or incidentally, but more

commonly CT is used for staging once the diagnosis is suspected. Ideally, CT should be performed with oral and intravenous contrast material during the venous phase of enhancement. Positive oral contrast material is useful for bowel wall implants and negative oral contrast material is useful for calcified tumor implants.¹ Peritoneal tumor implants less than 1 cm in size can be difficult to detect, particularly in the absence of ascites. When lymph nodes measure greater than 1 cm in short axis, or when there are morphologic changes, such as rounded shape or necrosis, tumor involvement is suspected. Disadvantages of CT include radiation exposure, adverse reactions

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to iodinated contrast material, and lower soft tissue resolution compared with MR imaging.

MR imaging is often used for its superior soft tissue resolution and tissue characterization permitting better assessment of a primary tumor's extent and local invasion of adjacent structures. MR imaging of the abdomen is also helpful for detecting metastatic disease, especially if liver lesions on CT are indeterminate. For routine pelvic MR imaging protocols, it is recommended that patients fast for at least 4 hours prior to the examination to reduce motion artifact from bowel peristalsis, and antiperistaltic agents can also be used. MR imaging assessment of local invasion is best assessed in 2 perpendicular planes, the sagittal and transverse to the long axis of the uterus. Vaginal gel is useful for assessment of vaginal masses and cervical lesions. Additional MR imaging sequences serve as excellent problem-solving tools. Dynamic contrast-enhanced imaging is useful for the detection of hypervascular tumors. Chemical shift or fat-suppressed imaging sequences are ideal for the detection of fat within lesions. Fat-suppressed postcontrast T1-weighted images facilitate detection of peritoneal tumor implants. Diffusion-weighted imaging (DWI) is sensitive to water molecule motion at the cellular level.² Malignant tumors, for example, are more likely to demonstrate high signal intensity on high b-value (1000) DWI and appear dark on apparent diffusion coefficient (ADC) maps. DWI combined with dynamic contrast-enhanced MR imaging can improve tumor characterization and staging; assess for distant spread, including detection of subtle peritoneal disease; and assess tumor response and recurrence.³ DWI and its corresponding ADC maps can improve tumor characterization and staging in patients with endometrial and cervical carcinoma but is less specific when differentiating between benign and malignant myometrial tumors and ovarian masses.⁴ When patients are unable to receive intravenous gadolinium chelates due to renal dysfunction, DWI is of particular benefit. Despite its lack of ionizing radiation, disadvantages of MR imaging include its limited availability worldwide, higher cost, long image acquisition times leading to motion artifact, and decreased patient compliance and safety issues related to MR imaging unsafe or conditional devices.

ENDOMETRIAL CANCER

Introduction

Endometrial cancer is the most common gynecologic malignancy and the fourth most common malignancy in women in the United States. It primarily presents in the sixth to seventh decades as

postmenopausal bleeding. Due to the early presentation in general, patients have a higher survival rate than that seen in other gynecologic malignancies. Currently, FIGO recommends surgical staging, although the guidelines continue to evolve.⁵

Endometrial carcinomas are subdivided into 2 groups. Type 1 includes grades 1 and 2 endometrioid carcinomas and comprises approximately 80% of endometrial carcinomas. Type 2 includes serous, clear cell, and mucinous carcinomas, carcinosarcoma, and grade 3 endometrioid carcinomas. Due to the poorer prognosis associated with type 2 carcinomas, the NCCN guidelines have separate treatment recommendations.⁶ Specific risk factors affecting survival include myometrial invasion, cervical stromal involvement, lymphovascular space invasion, level of lymph node involvement, and distant spread.⁷

Staging and Treatment

Surgical staging currently includes total abdominal hysterectomy (TAH), bilateral salpingo-oophorectomy (BSO), peritoneal washings, and lymph node sampling. Routine lymph node sampling is highly controversial due to the high rate of complications and the surgical skill required. Level of lymph node involvement is especially important for prognosis and survival; therefore, imaging to preselect patients requiring lymph node dissection is helpful for surgical management. Although fewer than 5% of patients with less than 50% myometrial invasion have lymph node involvement, a much higher percentage of patients with greater than 50% myometrial invasion or lymphovascular invasion have lymph node involvement.⁸

For type I endometrial carcinomas, treatment typically includes TAH/BSO with optional radiation therapy confined to the uterus for stages I and II. In stages III and IV, resection plus systemic chemotherapy and/or radiation therapy is recommended. If there is cervical involvement, a radical hysterectomy plus BSO and radiation therapy is indicated. Type II endometrial carcinomas tend to be more aggressive, and therefore systemic chemotherapy is recommended in tumors as early as stage IB.

Imaging

For endometrial carcinoma, the ACR Appropriateness Criteria (ACRAC)⁹ and NCCN strongly recommend pelvic MR imaging without and with intravenous contrast material to assess depth of myometrial invasion and tumor extent for treatment planning. In the evaluation of locally advanced disease, MR imaging with contrast is superior to contrast-enhanced CT, ultrasonography, and MR imaging without intravenous contrast. Pelvic CT

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