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Magnetic Resonance Imaging of Gynecological Malignancies: Role in Personalized Management

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Gynecological malignancies are a leading cause of mortality and morbidity in women and pose a significant health problem around the world. Currently used staging systems for management of gynecological malignancies have unresolved issues, the most important being recommendations on the use of imaging. Although not mandatory as per the International Federation of Gynecology and Obstetrics recommendations, preoperative cross-sectional imaging is strongly recommended for adequate and optimal management of patients with gynecological malignancies. Standardized disease-specific magnetic resonance imaging protocols help assess disease spread accurately and avoid pitfalls. Multiparametric imaging holds promise as a roadmap to personalized management in gynecological malignancies. In this review, we will highlight the role of magnetic resonance imaging in cervical, endometrial, and ovarian carcinomas.

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Introduction

Gynecological malignancies are a leading cause of mortality and morbidity in women around the world. They account for nearly 20% of visceral malignancies with uterine cancer being the most common in the developed world and cervical cancer being the most common in the developing world; however, the highest mortality is seen with ovarian cancer.[1] The management of gynecological malignancies has unresolved issues, the most important being the recommendations on the use of imaging.[2] However, cross-sectional imaging with computed tomography [CT] or magnetic resonance imaging [MRI] plays a significant role and their relative strengths and limitations in imaging these malignancies are shown in Table 1 (Fig. 1). In this review, we will describe the role of MRI in cervical, endometrial, and ovarian carcinomas (Fig. 2). Patient preparation and prerequisites are discussed in Figure 3 and Table 2 gives the value of various MRI sequences in these malignancies.

Cervical Cancer

Uterine cervix consists of 2 parts, the vaginal part also called portio and the supravaginal cervix. The portio protrudes into the vagina and is covered with squamous epithelium that continues into the vagina (Fig. 4). The supravaginal cervix is covered by columnar cells. The transitional zone is called the squamocolumnar junction (SCJ) and is an exclusive bed for carcinogenesis leading to the development of cervical carcinoma.[3,4] The SCJ moves upward with age so that tumors of the vaginal cervix appear exophytic in younger patients and endocervical at an older age.

More than 99% cervical cancers are associated with human papilloma virus. Squamous cell carcinoma is the most common histopathological type accounting for nearly 90% of the cases followed by adenocarcinoma that comprises 5%-10%. Other rare histopathologies include small cell carcinoma, adenosquamous carcinoma, and lymphoma[5] Cervical cancer

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Table 1 CT and MRI in Gynecological Malignancies: Strengths and Limitations

CT	MRI
(−) Decreased soft tissue contrast	(+) Superior soft tissue characterization
(−) Tumor depiction poor, early-stage disease is not delineated well	(+) Better tumor delineation, accurate within 0.5 cm of surgical size in 70%-90%
(−) Functional information is not available	(+) Multiparametric imaging provides information regarding tumor biology
(−) Limited role in planning brachytherapy and post-RT assessment	(+) Superior to CT for planning and postradiation assessment especially in brachytherapy
(−) Indeterminate results in residual/recurrent/ postoperative changes	(+) Improved characterization and differentiation of recurrent disease
(+) Rapid scanning, greater body coverage	(−) Longer duration, motion artifacts, poor body coverage

is a relatively slow-growing malignancy, but with early lateral extension along the parametrium and uterosacral ligaments. The disease can spread inferiorly along the vagina and laterally to the paracervical space and may invade the urinary bladder, rectum, pelvic sidewalls, and para-aortic nodes in advanced disease or in large-volume tumors.[2,6] Early diagnosis, accurate staging, recent advances in radiation therapy, and more effective chemotherapy have led to improvement in disease outcome and survival; however, it still remains one of the most frequent causes of death in women.[6,7]

Role of Imaging in Management

Cervical cancer is staged as per the International Federation of Gynecology and Obstetrics (FIGO) criteria that is predominantly based on clinical examination and hence has major limitations owing to inadequate assessment of tumor volume (particularly in endophytic tumors), parametrial invasion, pelvic sidewall involvement, and lymph node metastasis.[8,9] As compared to surgical staging, the earlier FIGO staging was found to be erroneous in up to 32% of patients with stage IB disease and up to 65% of patients with stage III disease.[10,11]

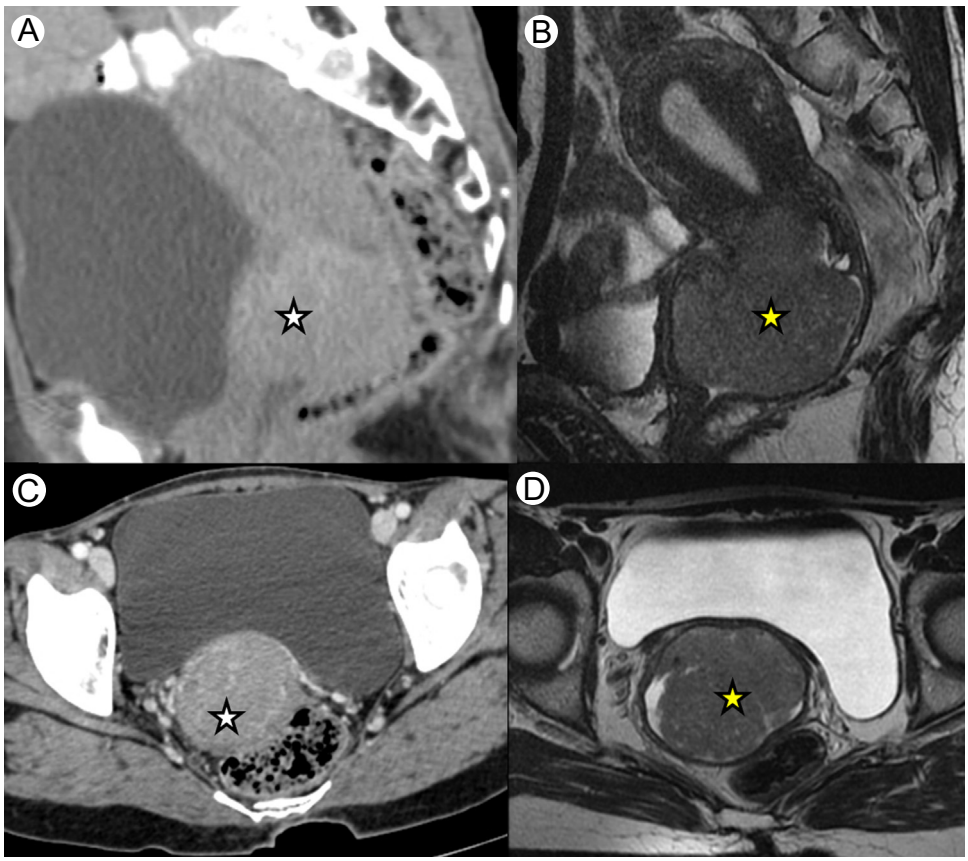

Figure 1 CT vs MRI in gynecological malignancies. Postcontrast sagittal CT reformation and axial postcontrast CT (A and C) shows bulky cervix with a subtle heterogeneously enhancing lesion within (white star). Owing to limited soft tissue contrast, further information regarding invasion of the adjacent viscera is not distinctly available on CT imaging, which is crucial for staging the disease. The lesion is well delineated on the sagittal and axial T2W MRI (yellow star) (B and D) suggestive of stage IIb. (Color version of figure is available online.)

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