Imaging malignant gynaecological conditions

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Abstract

Radiology continues to play an essential role in the management of malignant gynaecological conditions. Multiple imaging modalities are utilised to investigate suspected gynaecological malignancy including: ultrasound, computed tomography, magnetic resonance imaging and positron emission tomography/computed tomography. Each modality has a different role in diagnosis, staging, treatment selection and follow-up. This review discusses the different imaging modalities and their recommended roles in the imaging of malignant gynaecological disease. The imaging findings of common female pelvic pathology are discussed and illustrated.

Keywords cervical cancer; diagnostic imaging; gynaecology; ovarian neoplasms; uterine cancer; uterine neoplasms

Imaging modalities

A number of imaging modalities can be used to investigate suspected malignant gynaecology disease including: ultrasound (US), computed tomography (CT), magnetic resonance imaging (MRI) and fluorine-18-fluoro-2-deoxy-D-glucose (FDG) positron emission tomography/computed tomography (PET/CT). This review will discuss the advantages of the various different imaging modalities in gynaecological malignancy. For further details regarding the individual techniques, please refer to "Imaging benign gynaecological conditions".

Ultrasound (US)

US is the primary imaging modality in the initial assessment of suspected gynaecological malignancy. It is a good, relatively cheap, initial screening test in symptomatic women to assess endometrial thickness and identify adnexal masses. It is of limited value in cervical malignancy diagnosis or staging. Colour Doppler is utilised to assess the vascularity of ovarian lesions, which can help characterisation. When ovarian carcinoma is unsuitable for primary surgery, US is used to guide biopsy of ovarian masses and peritoneal deposits and guide the drainage of ascites.

Main indications for MRI of malignant gynaecological conditions

Organ	Indication
Uterus	Staging of endometrial and cervical cancer
Adnexa	Characterisation of adnexal masses
Vagina/vulva	Staging of vaginal and vulval cancer
Other	Evaluation of recurrent endometrial, cervical, ovarian cancer

MRI, magnetic resonance imaging, in malignant gynaecological conditions.

Table 1

Magnetic resonance imaging (MRI) and diffusion weighted imaging (DWI)

MRI has excellent soft tissue contrast and spatial resolution making it the imaging modality of choice in the local staging of uterine and cervical cancer and in the characterisation of adnexal lesions, when the US findings are indeterminate. See Table 1 for a summary of the main indications for MRI in malignant gynaecological conditions.

T2-weighted images (T2WI) are helpful in demonstrating pathology, as the presence of tumour causes distortion of the normal anatomy and alters signal characteristics on MRI.

T1-weighted images (T1WI) are useful to detect enlarged lymph nodes and bone marrow metastases. In addition, it is utilised for ovarian lesion characterisation as blood and proteinaceous products are high signal intensity on T1WI. Intravenous administration of gadolinium is often used for characterisation of adnexal lesions and staging endometrial cancer.

Diffusion weighted imaging (DWI) provides information about the free movement of water molecules, which is affected by tissue cellularity and cell membrane integrity. DWI is useful in staging of both endometrial and cervical tumours, monitoring treatment response and has a role in characterising pelvic masses. Several studies have reported that a combination of DWI with conventional MRI improves lesion detection and radiologist confidence in imaging interpretation of the primary tumour, involved lymph nodes and metastases (Figure 1).

Computed tomography (CT)

The role of CT in the imaging of the malignant gynaecology disease is in staging gynaecological malignancies by identifying enlarged lymph nodes, peritoneal deposits and other distant metastases and in the detection of recurrent pelvic tumours.

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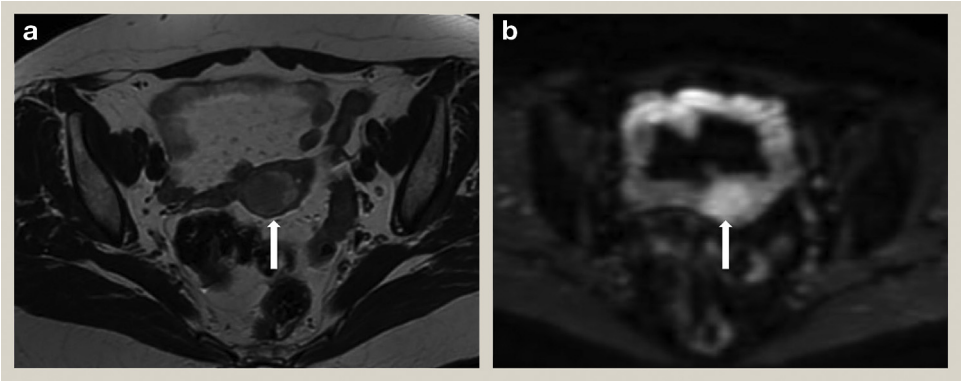

Figure 1 (**a**) Axial T2W magnetic resonance image demonstrating an intermediate signal intensity mass within the endometrial cavity (white arrow). (**b**) Corresponding axial DWI image demonstrating high signal intensity representing restricted diffusion within the endometrial cancer (white arrow).

FDG-positron emission tomography/computed tomography (FDG-PET/CT)

FDG-PET/CT is a functional imaging tool that uses short-lived radionuclides attached to tracers to image metabolic processes in the body in combination with a low-dose CT for localisation purposes. The most commonly used radiotracer is fluorine-18-fluoro-2-deoxy-D-glucose (FDG), which is metabolised as glucose. Therefore, the increased glucolytic rate of many malignant tumours enables their detection with FDG-PET.

However, it must be remembered that FDG uptake is not specific to malignant processes and physiological uptake is commonly seen in the uterus, ovarian follicles and corpus lutea in premenopausal patients. FDG uptake can also be seen in certain benign ovarian and uterine tumours as well as inflammatory and infectious processes.

Uterus

Malignant uterine conditions: approximately 90% of uterine carcinomas are adenocarcinomas arising from the uterine epithelium. Other potential histological subtypes are adenocarcinomas with squamous differentiation, adenosquamous carcinoma, clear cell carcinoma and serous papillary carcinoma. Uterine sarcomas only account for 2–5% of malignant uterine tumours. Primary uterine lymphoma presents in only 1% of patients with lymphoma. Uterine metastases from non-gynaecological neoplasms are rare.

Endometrial carcinoma: endometrial carcinoma is the most common invasive gynaecological malignancy. It presents as post-menopausal bleeding (PMB), often at an early stage when standard treatment is total abdominal hysterectomy and bilateral salpingo-oophorectomy.

US is the primary imaging modality to assess endometrial thickness in all women presenting with PMB. An endometrial thickness ≥4 mm in a patient with PMB requires further investigation with hysteroscopy. It is impossible to distinguish between benign endometrial polyps, endometrial hyperplasia and stage IA endometrial carcinoma using US alone (Figures 2 and 3) and therefore an endometrial biopsy is required.

The staging system for endometrial cancer is based on the stages accepted by the Fédération Internationale de Gynécologie et d'Obstétrique (FIGO). Prognosis and treatment depend upon the stage of disease. The depth of myometrial invasion, extension into the cervical stroma and the presence of lymph node metastases are the most important prognostic factors as they correspond to increased risk of lymphovascular space invasion and therefore risk of recurrence. MRI is able to detect these risk factors pre-operatively and therefore guide management (Figure 4). MRI provides further useful information including the size of the uterus, tumour size, presence of ascites and adnexal pathology, therefore providing valuable information to decide

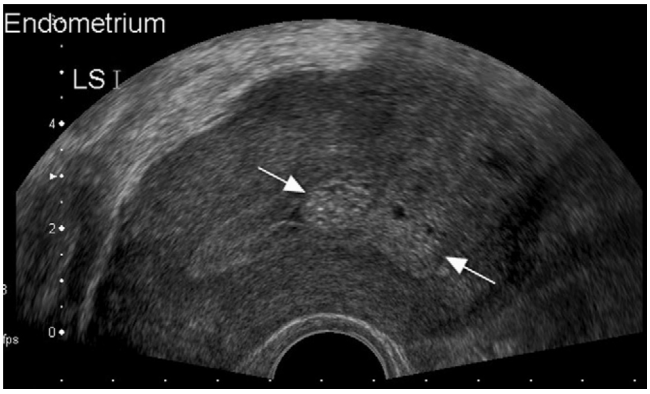

Figure 2 Transvaginal ultrasound demonstrating endometrial thickening (white arrows) secondary to a polyp.

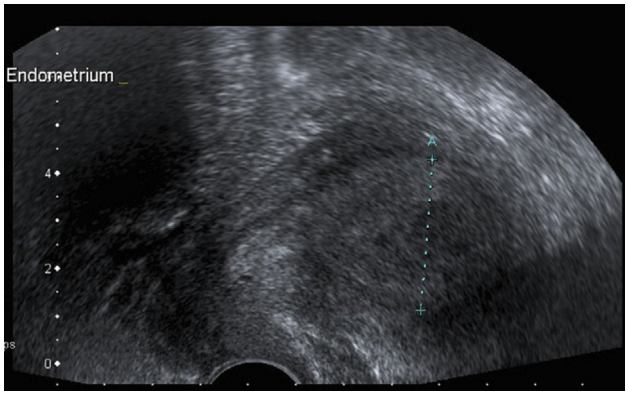

Figure 3 Transvaginal ultrasound of endometrial thickening secondary to endometrial carcinoma.