Reported by Dr Edit Franko ,Specialist Registrar Radiology Aberdeen Royal Infirmary. GMC 7132081  
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Clinical information  
 76 yr multiparous lady with confirmed Lynch syndrome with PMB. USS ET 18 mm. Underwent hemicolectomy and anastomosis for confirmed bowel cancer in 2022. Previous ovarian cystectomy in 1988.   
 Underwent EB in clinic. Confirmed FIGO grade 2 endometrioid adenocarcinoma. Known to clinical genetics team. - Local spread and evidence of mets   
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Technique: MRI pelvis   
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Findings: Previous CT from 29/06/2021 noted.  
The anteverted uterus measures 70 x 50 x35 mm.

In keeping with presented history of Grade 2 Type EC, a lobulated mass noted expanding endometrial cavity - measuring approximately 33 mm X 31 x 41 mm. Shows restricted diffusion, hypoenhancing than myometrium dynamic contrast enhanced images, T2 intermediate signal and T1 isointense signal. it is invading more than 50% of myometrium but the outer outline of the myometrium is still intact. No invasion of the serosa or parametrium. No invasion of the bladder or rectum. No extension into cervix.

Ovary is not clearly defined, but unremarkable adnexae.

Small posterior wall interstitial fibroid measuring only approximately 8 mm.

No parametrial, Obturator or inguinal adenopathy. No paraortic adenopathy.  
Atrophic ovaries. No adnexal mass. Normal Vagina.  
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Simple cysts in the liver and both kidney. No hydronephrosis.

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**Conclusion:**  Grade 2 Type 1 (Endometrial adenocarcinoma) FIGO stage IB - in keeping with Intermediate Risk endometrial carcinoma.

2.4 Tumor Spread

The most common way of diffusion of endometrial carcinoma is direct infiltration of adjacent structures. In particular, EC, which arises within the endometrium, usually begins its spread by infiltrating the superficial myometrium (i.e., the junctional zone). The neoplasm may then advance infiltrating deeper myometrial portions, usually by means of a wide infiltrating front. In advanced stages, EC may also reach the serosa and extend to peritoneal cavity and to adjacent organs. A less common way of direct spread of EC involves cervical epithelium and cervical stroma with possible extension to vaginal walls [[15](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR15), [16](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR16)].

The second most common way of diffusion of EC involves the lymphatic pathways that lead to the parametrial, paracervical, and obturator lymph nodes, in case of tumors of the middle and lower uterine portions, and to the common iliac and para-aortic lymph nodes, in case of neoplasms involving the uterine fundus and tubaric angles [[15](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR15)–[17](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR17)]. Inguinal nodes may also be involved by means of a spread along the round ligament following adnexal or pelvic sidewall tumor involvement. The probability of lymphatic spread is minimal for neoplasms confined to the inner myometrial portion and increases parallel to the depth of myometrial infiltration [[18](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR18), [19](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR19)]. Moreover, the presence of cervical stromal infiltration and the histologic diagnosis of non-endometrioid-type EC are also associated with a significantly increased risk of nodal metastases.

Tumor extension to the uterine cornua and to Fallopian tubes provides another route of spread to adnexal structures and the peritoneal cavity; this kind of spread is obviously more common for tumors involving the uterine fundus and tubaric angles than for the ones involving the uterine body or neck [[15](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR15), [16](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR16), [20](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR20)].

Distant hematogenous metastases usually occur late in the biological history of EC, usually in locally advanced cases or in histological subtypes with poor prognosis, and mainly involve the lungs, liver, and bone marrow [[8](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR8)].

2.5 Tumor Staging

Since 1988, the FIGO (International Federation of Gynecology and Obstetrics) defines formal staging of endometrial carcinoma subdividing the neoplasms into four main stages (stage I, tumor confined to the corpus uteri; stage II, tumor involving cervical stroma; stage III, local/regional tumor spread; and stage IV, tumor invading other organs/structures) according to surgical and pathological data acquired after complete abdominal hysterectomy with bilateral salpingo-oophorectomy, pelvic and retroperitoneal lymphadenectomy, omentectomy or omental biopsies, and peritoneal washing [[21](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR21), [22](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR22)].

The 2009 revision (Table [2.1](https://radiologykey.com/mri-of-endometrial-carcinoma/#Tab1)) of the 1988 FIGO classification of endometrial carcinoma is the one actually in use; it maintained the four main stages (I–IV) of differentiation, but simplified some further subdivisions. Stage I is actually subdivided into two substages (vs. 3 substages in the previous classification): Stage IA is characterized by myometrial infiltration <50 % of its thickness, and stage IB by myometrial infiltration >50 % of its thickness; no more difference is made between EC that exclusively involve the endometrium and EC that also infiltrate the inner half of the myometrium. Stage II actually has no substages (vs. 2 substages in the previous classification): cervical mucosa infiltration is no longer considered a staging parameter, whereas cervical stromal infiltration remains its unique characteristic. Stage III maintained three substages: stage IIIA is characterized by serosa and/or adnexal infiltration, stage IIIB by vaginal and/or parametrial involvement, and stage IIIC by nodal metastases. Two differences exist between the 1988 and 2009 classification of stage III: positive peritoneal cytology is no more considered a staging criteria (previously it was included in stage IIIA), and stage IIIC has been further subdivided into IIIC1 (pelvic nodal involvement) and IIIC2 (lomboaortic nodal involvement). No differences exist between the 1988 and 2006 classification of stage IV that maintained two substages: stage IVA, characterized by bladder and/or rectal infiltration, and stage IVB, showing distant metastases (including inguinal lymph nodes).

***Table 2.1***

The 2009 FIGO staging system of endometrial carcinoma and corresponding MRI features

| **Stage** | **FIGO description** | **MRI features** |
| --- | --- | --- |
| IA | No/less than half myometrial invasion | Myometrium shows normal signal intensity profoundly to the neoplasm >50 % of its thickness |
| IB | Equal to/more than half myometrial invasion | Myometrium shows normal signal intensity profoundly to the neoplasm <50 % of its thickness but serosa hypointense rim is preserved |
| II | Cervical stroma infiltration | Interruption/signal intensity alteration of cervical stroma hypointense ring |
| IIIA | Serosa infiltration and/or adnexal involvement | Interruption/signal intensity alteration of serosa hypointense rim and/or presence of an adnexal mass |
| IIIB | Vaginal and/or parametrial involvement | Signal intensity alteration extending to the vagina and/or to the parametria |
| IIIC1 | Pelvic lymph node metastases | Pathologically enlarged (>10 mm in minimum diameter) pelvic lymph nodes |
| IIIC2 | Para-aortic lymph node metastases | Pathologically enlarged (>10 mm in minimum diameter) retroperitoneal lymph nodes |
| IVA | Bladder and/or bowel mucosa infiltration | Loss of cleavage plans between the neoplasm and the bladder and/or the bowel walls that appear thickened |
| IVB | Distant metastases (including inguinal lymph nodes) | Pathologically enlarged (>10 mm in minimum diameter) inguinal lymph nodes or other distant metastases (often not comprised in MRI scans) |

2.6 Prognosis

The prognosis of a patient affected by EC is overall better than for other gynecological malignancies, but it depends on the histological type, tumor grade, and tumor stage.

Non-endometrioid-type EC is associated with an overall poor prognosis; indeed, although representing only about 20 % of the cases, non-endometrioid EC account for more than 50 % of all recurrences and deaths for endometrial carcinoma [[23](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR23)]. On the other hand, endometrioid-type EC show an extremely variable prognosis, depending on the tumor grade and stage; for example, the prevalence of nodal metastases, which are correlated with a poor prognosis, is significantly higher in patients affected by G2–G3 endometrioid-type EC than in patients affected by G1 ones.

Besides tumor type and grade, the 5-year survival rates (5 years) of endometrial carcinoma are also strictly correlated with tumor stage at the time of diagnosis. Stage IA EC show a 5 years of about 89.6 %, stage IB ones of 77.6 %, and stage II of 70.2 %. The 5 year survival rates of EC significantly decrease for stage III neoplasms, to about 49.2 %; the presence of nodal metastases is associated with 5 years of 57 % for pelvic nodal involvement only (stage IIIC1) and 49 % for para-aortic nodal involvement (stage IIIC2) [[24](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR24)]. Stage IV EC is associated with an extremely poor prognosis, with a 5 years of 18.7 %.

The patient’s overall physical performance status and age are also strictly correlated with prognosis [[25](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR25)].

2.7 Treatment

The standard surgical treatment for endometrial carcinoma implies laparotomy and comprises complete hysterectomy with bilateral salpingo-oophorectomy, pelvic and retroperitoneal lymphadenectomy, omentectomy or omental biopsies, and peritoneal washing. Nowadays, however, the improvements in preoperatory staging techniques, namely, ultrasound (US), magnetic resonance (MR), and computed tomography (CT), and in surgical techniques have determined an increase in the request of less invasive treatment approaches. Currently, laparoscopy and robotic surgery approach are preferred over laparotomy in the large majority of cases, and a recent publication by the Gynecologic Oncology Group (GOG), the LAP2 study, has shown that laparoscopy provides equivalent results in terms of disease-free survival and overall survival, compared with laparotomy, with the advantage of shorter hospital stay, less use of painkillers, lower rate of complications, and improved quality of life [[24](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR24)]. Moreover, despite the surgical approach, nowadays the extent of surgery must also be modulated according to histological data and to preoperative staging findings; for example, lymphadenectomy, which is burdened by significant complication rates and postoperative morbidity, has shown no benefits in terms of survival and recurrence-free rates in patients affected by low-risk (grade 1, stage IA) EC [[26](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR26)–[28](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR28)], whereas it remains crucial for improving the prognosis in high-risk patients [[29](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR29)–[31](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR31)].

Adjuvant chemotherapy is usually administered to all patients affected by non-endometrioid-type EC or by endometrioid-type G2–G3 ones and to patients affected by FIGO stage II to IV neoplasms. Patients affected by surgically unresectable EC and patients showing absolute clinical contraindications to surgery may benefit from radiation therapy in order to reduce bleeding risk; however, maximal surgical debulking should be performed also in case of unresectable neoplasms in order to increase life expectancy. In case of hemorrhage, uterine artery embolization may be useful for reducing and/or stopping blood loss.

Therefore, in the era of individualized treatments, an accurate preoperative staging is crucial in order to tailor the best surgical approach for each patient. Many imaging modalities are actually available for locoregional staging of endometrial carcinoma, but magnetic resonance imaging must be considered the imaging modality of choice, thanks to its panoramicity, high tissue contrast resolution, and reproducibility [[32](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR32)–[36](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR36)].

2.8 The Role of MRI in Endometrial Carcinoma

MRI is not indicated for diagnosing endometrial carcinoma; indeed, although recent studies have demonstrated that apparent diffusion coefficient (ADC) values can reliably differentiate benign from malignant endometrial lesions [[37](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR37), [38](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR38)], hysteroscopy with endometrial biopsy remains the gold standard for this aim. On the other hand, nowadays MRI plays a well-defined role in the preoperative workup of patients with histologically proven EC [[31](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR31), [39](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR39)–[43](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR43)].

The main aims of preoperative MRI staging of endometrial carcinoma are the assessment of “T” stage (i.e., the quantification of the depth of myometrial infiltration, the identification of cervical stromal infiltration, and the assessment of extrauterine spread) and the definition of “N” stage (i.e., the identification of nodal metastases). MRI offers an overall high accuracy (81–92 %) [[43](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR43), [44](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR44)] in the definition of the “T” stage of endometrial carcinoma, which is significantly higher in comparison to CT, PET/CT, and transvaginal ultrasound [[33](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR33)–[35](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR35), [45](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR45)–[48](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR48)], but still lower than intraoperative pathological evaluation of frozen sections [[49](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR49), [50](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR50)]. Recent works report a high accuracy of MRI (89–97 %) [[51](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR51), [52](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR52)] also in the evaluation of the “N” stage of endometrial carcinoma. Such promising results, however, must be critically evaluated because of the influence of low pretest probability of nodal metastases in endometrial carcinoma (about 20 %). Indeed, the sensitivity of MRI in identifying nodal metastases, as reported in the same abovementioned studies, ranges from 55 to 67 %. However, despite the unsatisfactory sensitivity of MRI in directly recognizing nodal metastases, the MRI information about the “T” stage and, in particular, about the depth of myometrial infiltration and the presence of cervical stromal infiltration, in association with pathologic information about the tumor type and grade, enables to confidently predict the risk of nodal metastases, subdividing endometrial carcinoma into three groups (low, intermediate, and high risk) (Table [2.2](https://radiologykey.com/mri-of-endometrial-carcinoma/#Tab2)) with consequent therapeutic implications [[30](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR30), [36](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR36), [40](https://radiologykey.com/mri-of-endometrial-carcinoma/#CR40)].

***Table 2.2***

Risk stratification for the presence of nodal metastases and for recurrence of endometrial carcinoma (EC), according to MRI and pathology data

|  | **MRI stage** | **Histological type** | **Histological grade** |
| --- | --- | --- | --- |
| Low-risk EC | T1a | Type 1 | G1–G2 |
| Intermediate-risk EC | T1a | Type 1 | G3 |
| Intermediate-risk EC | T1b | Type 1 | G1–G2 |
| High-risk EC | T1b | Type 1 | G3 |
| High-risk EC | T≥2 | Type 1 | G1–G2–G3 |
| High-risk EC | Every T | Type 2 | G3 |

The secondary aims of preoperative MRI in EC are the evaluation of pelvic anatomy and the recognition of eventual pelvic comorbidities; the latter information, in particular, can be extremely helpful for a correct surgical planning. For example, the identification of coexistent large pelvic masses (Fig. [2.3](https://radiologykey.com/mri-of-endometrial-carcinoma/#Fig3)) or of voluminous uterine fibromas might advise against a laparoscopic or transvaginal approach.