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Original Article

Staging of endometrial carcinoma by Magnetic Resonance Imaging: Correlation with surgery and histopathology

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Abstract

Objective: To evaluate the accuracy of MRI in staging of endometrial carcinoma, and comparison with surgery and histopathological findings.

Methods: A one year prospective cross-sectional study was conducted from 10/3/2005 to 31/5/2006, at the Radiology department, Aga Khan University Hospital (AKUH) Karachi. Fifty two patients with diagnosis of endometrial carcinoma, referred to radiology department for preoperative staging by MRI and had undergone surgery were included.

Results: MRI was found to be 79% sensitive, 85% specific and 80% accurate for staging endometrial carcinoma while PPV and NPV were 97% and 66% respectively.

Conclusion: Magnetic resonance imaging is a good, safe, accurate and non invasive imaging modality in staging of endometrial carcinoma. It can be used as a first line radiological investigation in patients with endometrial carcinoma for treatment planning (JPMA 59:622; 2009).

Introduction

The peak age at presentation for endometrial carcinoma is approximately sixty years. Ninety percent of these women present with abnormal vaginal bleeding and 75% present with stage 1 disease.[1] Prognostic factors, which influence the treatment algorithm in endometrial carcinoma include grade of tumour, histological type, depth of myometrial invasion, cervical involvement and lymphadenopathy.[2,3] Prior to 1998 endometrial carcinoma was staged by examination under anaesthesia, hysteroscopy and dilatation and curettage. This resulted in understating of 13-22% of cases. Routine surgical staging (total abdominal hysterectomy and bilateral salpingo-oophorectomy with peritoneal washes with or without pelvic and paraaortic lymphadenopathy) was recommended by FIGO in 1998. Deep myometrial invasion to the outer half of the myometrium (FIGO stage 1C) is a poor prognostic factor, which is associated with an increased risk of pelvic and paraaortic lymphnode metastases. The recent introduction of less-invasive surgical techniques requires a more accurate preoperative work-up to prevent the risk of understaging the disease and impair the therapeutic plan.[4-8] Spread of tumour to adjacent tissues is assessed by a combination of clinical and imaging modalities. Cross sectional imaging such as computed tomography and magnetic resonance imaging is not officially part of the FIGO staging, however pelvic MRI, has the advantage of multiplanar data acquisition and is reported to be superior to CT and ultrasound because of inherent excellent soft tissue contrast.[9] Many studies[9-17] have shown the excellent accuracy of MR imaging in the preoperative assessment of the depth of myometrial invasion, the extent of cervical invasion, and identification of enlarged pelvic and lumboaortic lymph nodes separately. Data regarding our part of world is limited[18,19] and it is a relatively new topic for research in local environment and especially after recent advances in imaging techniques and availability of MRI equipment.

The purpose of this study was to evaluate the validity of MRI in the preoperative staging of endometrial carcinoma in our population and comparison with surgical and

histopathological findings.

Patients and Methods

Between April 2005 and March 2006, a total of 52 patients with endometrial adenocarcinoma, histologically documented by endometrial biopsy were referred to our department for MRI examination of the pelvis. These patients included outside referrals as well as inpatients. Informed consent was obtained from all patients. Patients with histologically proven endometrial adenocarcinoma were included in the study. Finally 50 patients were studied. Twenty patients were premenopausal and thirty were postmenopausal. Most common clinical presentation was postmenopausal bleeding (60%) followed by intermenstural bleeding (24%) and only 16% patients presented with postcoital bleeding. At histologic examination, 41 of 50 tumours were endometrioid adenocarcinoma, 5 were papillary serous adenocarcinoma and 4 were adenocarcinoma with squamous differentiation. All patients underwent surgery. Forty-four patients underwent type II radical hysterectomy, four type III hysterectomy and two had type 1 hysterectomy. Eleven patients were subjected to pelvic lymph node sampling, and ten patients had systematic pelvic and lumboaortic lymphadenectomy. MR imaging studies were performed with a 1.5-T superconducting magnet. The pelvic phased-array coil was used in all patients. Transverse T1-weighted, Transverse T2-weighted, Sagittal T2-weighted, short-axis (perpendicular to the main axis of the body of the uterus) T2-weighted RARE, dynamic MR imaging, after the administration of 0.1 mmol gadolinium per kilogram of body weight, was performed by using a quadraphasic technique, which enables acquisition of images at four phases (precontrast, arterial, venous, and equilibrium) relative to the injection of the contrast material. Dynamic imaging was performed by using a fast multiplanar spoiled gradient-echo (FMSPGR) pulse sequence. Images were reviewed on working console as well as on hard copies.

MR images were analyzed for, tumour signal intensity on T1- and T2-weighted images compared with that of adjacent myometrium, visibility of the junctional zone on T2-weighted images as a band of low signal intensity immediately subjacent to the endometrial stripe, the pattern of uterine enhancement at dynamic imaging, categorized as subendometrial enhancement, myometrial infiltration detected on T2-weighted images on the basis of disruption or discontinuity of the junctional zone and/or irregular myometrial enhancement at the endometrium-myometrium interface in all three types of myometrial enhancement, infiltration of the uterine cervix, detected as a high-signal-intensity mass within the endocervical canal and/or disruption of the normal low-signal-intensity cervical stroma and presence of enlarged pelvic and/or lumboaortic lymph nodes (cutoff value, 10 mm along the minimal transverse diameter). Quantitative image analysis included the signal-to-noise ratio in the tumour and myometrium during all phases of the dynamic study. Final MRI report was made by consultant radiologist having experience in MRI. Preoperative findings of all patients who underwent surgery were also recorded. Surgical specimens were sectioned along the longitudinal plane of the uterus. The depth of myometrial invasion was estimated grossly, and confirmed microscopically without knowledge of MR findings, and classified according to International Federation of Gynecology and Obstetrics classification. The total number of lymph nodes, their site, and the number of metastatic lymph nodes were subsequently documented by histopathologist. The imaging findings were compared with histologic and operative findings. Predefined Performa was used for data collection, data entered and analyzed by using computer program SPSS (version 15). Sensitivity, specificity, accuracy, NPV and PPV of MRI for staging endometrial carcinoma was calculated.

Results

MRI accurately staged presence of myometrial invasion in 39 (78%) and absence of myometrial invasion in 5 (10%) out of 50 patients (Table), stage IA (5), stage IB (20), stage IC (9), stage IIA (8), stage IIIC (1), stage IIB (1) which was statged as IIA although it was correctly diagnosed myometrial invasion. Myometrial invasion was under diagnosed in 5 (10%) patients. They were IB (less than 50% myometrial invasion) on surgery/histological staging and they were staged as IA. Cases which were IB were staged as IA. The reasons were that the bulky polypoid tumour distended the endometrial cavity thus attenuating myometrial tissue. One patient had a small uterus, less than 4 cms in longitudinal diameter and demonstrated marked thinning of myometrium.

Table: Accuracy of MRI in staging of endometrial carcinoma.

Author	Total patients	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy
Eun Jung Lee,[4]	46	Not mentioned	Not mentioned	Not mentioned	Not mentioned	80%
Pakkal MV,[20]	28	Not mentioned	Not mentioned	Not mentioned	Not mentioned	78%
Hricak H[13]	107	91.6	97.4	Not mentioned	Not mentioned	92%
Ricardo Manfredi,[1]	37	71.4	92.3	Not mentioned	Not mentioned	89%
Sironi S[21]	56	94.4	92.1	Not mentioned	Not mentioned	87.5%
Fatima et al	50	79	85	97	66	80%

Two patients had leiomyoma distorting uterine cavity. One patient had retroverted uterus and one had adenomyosis. Two percent cases of IA were overstaged as IIA on MRI, because cervical stroma was not clearly seen on MRI due to inflammation and it was predicted as stage IIA. Overall, MR imagings sensitivity, specificity, diagnostic accuracy, and positive and negative predictive values in assessing myometrial infiltration were 88%, 83%, 97%, 50%, 88% respectively. MRI also accurately staged presence of Cervical invasion in 8 (16%) and absence of cervical invasion in 40 (80%) out of 50 patients. One patient was underdiagnosed with cervical invasion. It was IIB and was staged as IIA because of a small uterus. We overstaged 1 case of IA as IIA, because cervical stroma was not clearly seen on MRI due to inflammation and we predicted it as stage IIA. Overall MR imaging sensitivity, specificity, diagnostic accuracy, and positive and negative predictive values in the assessment of cervical infiltration were, 64%, 66%, 65%, 91%, 25% respectively.

Discussion

Surgery is the treatment of choice in patients with noninvasive or locally advanced endometrial carcinoma. In this study, the capability of MR imaging was evaluated which can help to predict all factors requested by the gynaecologic oncologist to plan surgical treatment. Endometrial carcinoma could be easily detected on T2-weighted MR images than the detection on T1 weighted images because endometrial relaxation time is equivalent to that of adjacent myometrium, and therefore the two tissues appeared isointense on T1-weighted images. Determining the presence and depth of myometrial invasion is a highly critical factor, as is used in most institutions to predict nodal metastases, since patients with 50% or greater myometrial invasion have a six- to sevenfold increased prevalence of pelvic and lumboaortic lymph node metastases compared to patients with myometrial invasion in whom is absent or less than 50%. The presence and depth of myometrial infiltration can be assessed on T2-weighted images as an interruption of the junctional zone, which appears hypointense, contrary to endometrial adenocarcinoma, which appears hyperintense. In postmenopausal women, however, the junctional zone may be poorly visible and the myometrium may be thinned due to uterine involution, making the presence and depth of myometrial infiltration more difficult to assess. In fact, in our series, the junctional zone was poorly visible in eight patients. To overcome this limitation, dynamic MR imaging should be performed, because it can depict different enhancement times of the adenocarcinoma compared with those of the adjacent myometrium, which improves in this manner the contrast resolution of the tumour and myometrium. In our series, by combining T2-weighted and dynamic MR imaging, there was a significant correlation between MR imaging and histopathologic findings in the assessment of myometrial infiltration.

In this study we investigated only the local-regional staging of endometrial adenocarcinoma, focusing on those parameters that may change the surgical procedure for the gynaecologist. The diagnostic accuracy of MRI is comparable to that in previous publications (Table) with 79% sensitivity and 85% specificity. This represents, a limitation of this study, since a complete work-up of these patients should include the search for distant metastases or peritoneal implants. However, malignant peritoneal cytologic findings are found in 12%-19% of patients with endometrial carcinoma, and malignant peritoneal cytologic features have not been prognostic in women with early-stage disease. Another limitation of the study is that some patients had their lymph node status determined with histologic examination; the remaining lymph nodes were assessed by means of palpation, which has a lower certainty than histopathologic examination. Cases which were IB and were staged as IA, because of bulky polypoid tumour distended the endometrial cavity, thus attenuating the myometrium. One patient had a small uterus less than 4cms in longitudinal diameter and demonstrated marked thinning of myometrium. Two patients had leiomyoma distorting the cavity and one patient had retroverted uterus and another had adenomyosis. One case of IA was overstaged as IIA on MRI because cervical stroma was not clearly seen on MRI due to inflammation and it was predicted as stage IIA. Limitations of the study were that patients with II B, III A and IV disease were not present.

Conclusion

MR imaging coupled with contrast-enhanced dynamic technique is highly accurate in local-regional staging of endometrial carcinoma and can be used reliably for treatment planning.

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