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Original Research Article

Accuracy of MR Imaging in endometrial cancer: our experience

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ABSTRACT

Background: MRI is a useful modality for preoperative imaging in endometrial cancer. We report our experience in Indian population managed at a tertiary care center regarding accuracy of preoperative MRI in prediction of deep myometrial invasion and cervical stromal invasion.
Methods: 30 patients with endometrioid adenocarcinoma endometrium on endometrial biopsy underwent preoperative MRI in the week preceding surgery. MRI impression of depth of myometrial invasion, cervical stroma involvement and positive nodes were compared with final histopathology findings to calculate the accuracy of MRI.
Results: The accuracy of MRI for estimation of tumour size was 72% and for detection of myometrial invasion was 76%. The accuracy for detection of cervical, adnexal and nodal involvement was 96%, 100% and 96% respectively.
Conclusions: MRI is an accurate modality for preoperative assessment in endometrial cancer and can significantly assist in surgical planning.

Keywords: Diffusion weighted imaging, DCE MRI, Endometrial carcinoma, Myometrial invasion, Staging

INTRODUCTION

Endometrial cancer is the second commonest gynaecological cancer worldwide. SEER data shows that 83% cases are early stage (FIGO stages I and II) at diagnosis with good 5 year survival rates. Contemporary management of endometrial cancer in most cases is primarily surgical and includes peritoneal fluid cytology, extrafascial hysterectomy with bilateral salpingo-oophorectomy along with removal of bilateral pelvic and paraaortic lymph nodes for complete surgical staging. For FIGO Stage II disease with cervical stromal involvement, a modified Radical hysterectomy is recommended.

The baseline rate of nodal involvement inclusive of all stages is around 9%. Removal of negative nodes has not been shown to confer therapeutic benefit however adds significantly to operative, short and long term postoperative morbidity in, what is essentially a disease with good prognosis. A modality to assess the risk of nodal involvement preoperatively and to omit unnecessary nodal dissection with its attendant morbidity, in cases deemed to be at low risk of involvement, is a desirable option. Furthermore, preoperative assessment of cervical stromal involvement would enable the surgeon to plan a Type II radical hysterectomy in these cases to ensure optimal disease outcome.

In various studies done in western population, MRI has been shown to be reasonably accurate in identifying enlarged nodes, detection of myometrial invasion and its depth and identification of cervical stromal invasion. The accuracy varies depending on type of MRI sequence used and may be confounded by inflammation associated with previous biopsy.

No such study has been carried out in Indian population. The aim of the study is to assess accuracy of preoperative MRI in prediction of deep myometrial invasion and cervical stromal invasion in Indian population managed at a tertiary care centre.

METHODS

The study was commenced after obtaining institutional ethical clearance from hospital ethics review committee. 30 consecutive cases of biopsy proven endometrioid adenocarcinoma of endometrium were subjected to MRI Pelvis with abdominal screening in the week preceding definitive surgery with 1.5 Tesla (T) MRI magnet following a dedicated MRI protocol.

Imaging was performed after 3 hours of fasting to reduce bowel peristalsis and after 1 hour of voiding urine to achieve a partially filled urinary bladder. MRI was done in head first supine position using a pelvic phased array multicoil. MRI sequences used were high resolution T2 weighted imaging (T2WI) in 3 orthogonal planes (axial, sagittal and coronal) angled to the uterine cavity followed by fat saturated T2 weighted images; T1 weighted imaging(T1WI) in axial and sagittal planes followed by pre and post contrast dynamic contrast enhanced (DCE after gadolinium administration 0.1 mmol/kg body weight) axial and sagittal fat supressed T1 Fast Spin Echo (FSE); diffusion weighted imaging (DWI) MR sequences with b=0, b=500 and b=1000, followed by apparent diffusion coefficient (ADC) mapping. MRI findings of tumour size, disease confined to endometrium, superficial myometrial invasion, deep myometrial invasion and cervical stromal involvement were noted. Enlarged pelvic and paraaortic nodes defined as Short Axis Diameter (SAD) > 10 mm were considered significant. All patients underwent a comprehensive surgical staging with peritoneal fluid cytological examination, total abdominal extrafascial hysterectomy with bilateral salpingo-oophorectomy and bilateral pelvic and paraaortic lymphadenectomy till level of origin of inferior mesenteric artery. Patients with obvious cervical stromal involvement were posted for Type II Radical hysterectomy instead of Type I extrafascial hysterectomy. All other surgical procedures were identical. MRI findings were compared with final histopathology for concurrence on tumour size, depth of myometrial invasion, presence of adnexal, nodal and cervical stromal involvement (Figure 1).

Recording of data

- Demographic variables: Age, BMI
- Tumour related variables: Date of endometrial biopsy, Tumour size in cm, depth of tumour invasion in terms of absence of or superficial (< 50%) and deep (>= 50%) myometrial invasion, cervical stromal invasion and positive pelvic and paraaortic nodes were recorded from preoperative MRI findings and compared to final histopathological report.

Statistical analysis

Data was analysed using MS Excel, Epi Info -6 and SPSS 15.0 statistical software.

RESULTS

The demographic variables were as per Figure 1.

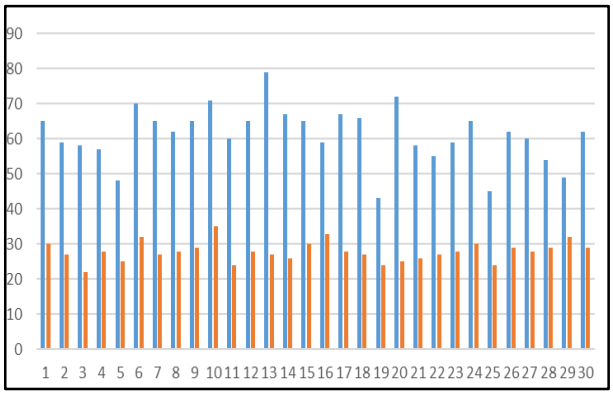

Figure 1: Demographic variables (Age and BMI).

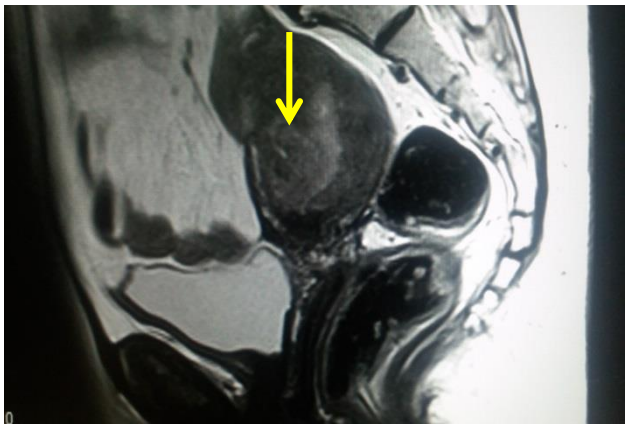

Figure 2: Sagittal view (involvement of myometrium in anterior aspect).

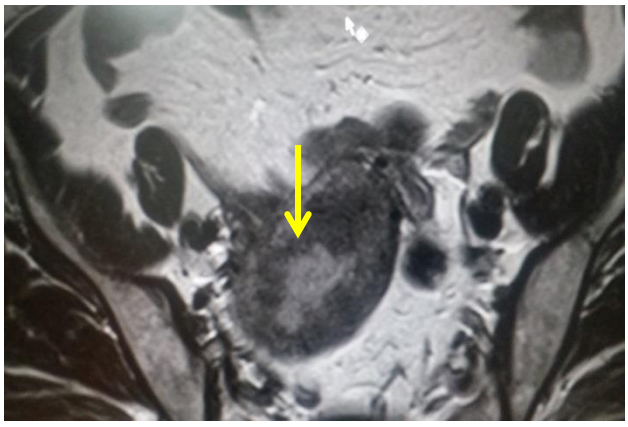

Figure 3: Coronal view (involvement of myometrium on the right lateral aspect).

In Figure 2 MRI T2 WI show hyperintense signals occupying endometrial canal and occupying more than 50% of uterine wall. Sagittal view showed involvement of myometrium in anterior aspect and coronal view showing involvement of myometrium on the right lateral

aspect-conforming to Stage I B of carcinoma endometrium.

Figure 4-6 shows the sensitivity of different MRI sequences in the evaluation of myometrial involvement in a patient of carcinoma endometrium-stage IA, which is seen extending to involve the myometrium in left lateral aspect. All the axial sections are at almost the same level.

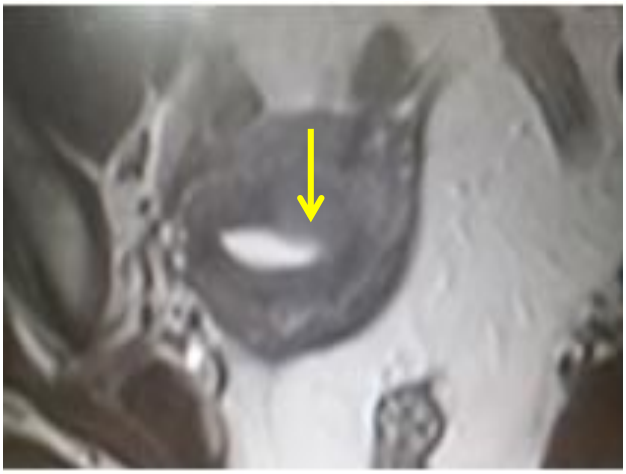

Figure 4: T2 WI axial showing hyper-intensity in the affected myometrium.

Figure 4 T 2WI showed mild hyperintensity in left side of myometrium with which is seen causing loss of the junctional zone at that level on the anterior aspect. In Figure 5, DWI at b value = 1000, showed hyperintensity at the same lesion with the next image showing the ADC mapping of the lesion showing dark signals suggestive of restricted diffusion.

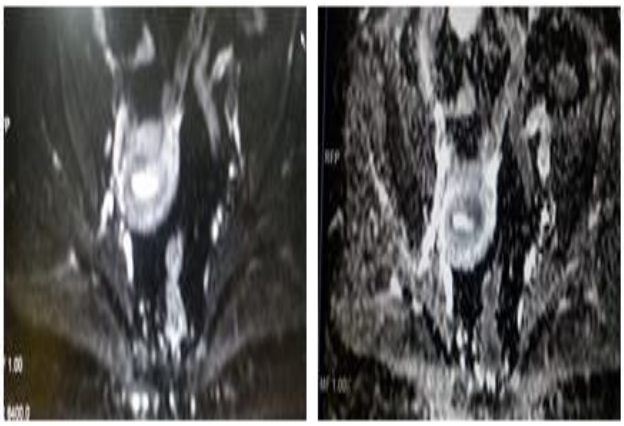

Figure 5: ADC mapping of the lesion.

Figure 6, post contrast early arterial phase images, showing no enhancement of endometrium but avid enhancement of the involved infiltrated myometrium. In delayed phase, there is enhancement of the entire tumour but it remains low in signal intensity compared to myometrium. Post resection, the lesion is found to be poorly differentiated adenocarcinoma.

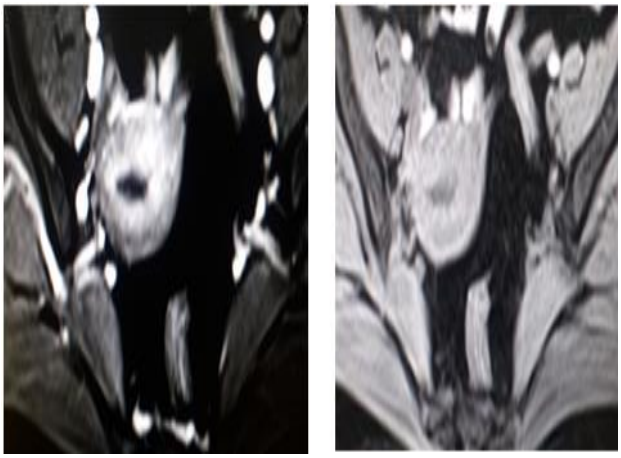

Figure 6: Post contrast early arterial phase on left, and delayed phase on right.

In early arterial phase, the involved myometrium showed avid enhancement, followed by enhancement of the entire tumor in delayed phase which remains low in signal intensity compared to adjacent myometrium.

The accuracy of MRI for tumour size was 72% with a sensitivity of 90%. There was a trend towards overestimation of tumour size. The accuracy of MRI for myometrial invasion was 76%. The PPV, NPV, sensitivity and specificity was 80%, 60%, 89% and 43%, respectively. The accuracy of MRI for detection of cervical stromal involvement was 96%. The PPV, NPV, sensitivity and specificity was 67%, 100%, 100% and 96%, respectively. The accuracy of MRI in identifying adnexal involvement was 100% with 100% PPV, NPV, sensitivity and specificity%. The accuracy of MRI in identifying pelvic nodal metastases was 96%. The PPV, NPV, sensitivity and specificity was 100%, 95%, 86% and 100%, respectively. The accuracy of MRI in identifying paraaortic lymph node metastases was 96%. The PPV, NPV, sensitivity and specificity was 100%, 95%, 75% and 100%, respectively.

DISCUSSION

The standard management of endometrial cancer is a surgical staging incorporating peritoneal cytology, hysterectomy with bilateral salpingo-oophorectomy, pelvic and paraaortic lymphadenectomy. In cases deemed to be at low risk for nodal metastases based on preoperative imaging or intraoperative frozen section, omission of lymphadenectomy can reduce surgical morbidity. Ovarian preservation can be offered to patients desiring fertility provided preoperative imaging accurately predicts absence of adnexal involvement. Deep myometrial invasion is a major risk factor for nodal metastases. Accurate prediction of deep myometrial invasion would enable the surgeon to decide on need for lymphadenectomy. In patients with cervical stromal involvement, the recommended surgery is Type II Radical hysterectomy with adnexectomy and

lymphadenectomy. Preoperative prediction of stromal involvement will allow the surgeon to choose the optimal surgery. MRI is the most accurate imaging modality for preoperative assessment in endometrial cancer. Various authors have investigated the use of 1.5 T, 3 T MRI systems and various sequences to improve the predictive value of MRI in western population. No such study is mentioned in Indian women population.

The lesion of endometrial carcinoma appear hypo to isointense in T1 WI; hyperintense on T2 WI ; show restricted diffusion in form of bright sign al in DWI at b values of 0, 500 and 1000 and dark signals in ADC mapping . Post contrast, the myometrium enhances early, followed by endometrial enhancement. The enhancement pattern of endometrium (early, progressive or delayed) remains low signal intensity compared to myometrial enhancement. The maximum signal intensity in tumour in delayed phase is lower than that of the adjacent tissue. One case of poorly differentiated adenocarcinoma showed early arterial enhancement at site of infiltration of myometrium with gradual enhancement of endometrium and unaffected myometrium (Figure 4-6).

Morakkabati-Spitz N et al compared the quality of images acquired using 1.5-T MRI and 3-T MRI in a group of 19 patients. Their study revealed comparable image contrast for the 1.5-T and 3-T protocols.[1] They concluded that there was no difference between the two systems in tumor diagnosis and staging. However, no case of endometrial cancer was considered in their population. Torricelli P et al in their study found a high specificity and PPV of 3T MRI for detection of deep myometrial invasion.[2] However, their study understaged the disease in upto 16% of cases. They concluded that their findings did not justify a preferential use of 3T over 1.5T imaging.

Lin G et al studied accuracy of DWI with 3T MRI and found 89% accuracy with fused T2 weighted and diffusion weighted imaging compared to 65% with T2 weighted images and 73% with dynamic contrast enhanced (DCE) images alone.[3] Das SK et al in their meta-analysis of usefulness of DWI in endometrial cancer patients found sensitivity and specificity for detection of deep myometrial invasion to be 90% and 89% respectively.[4] They concluded that DWI offered potential advantages over Dynamic Contrast enhanced MRI as it did not involve use of intravenous contrast which would be contraindicated in patients with renal impairment.[5]

McComiskey MH et al found sensitivity and specificity of preoperative MRI for detection of outer half myometrial invasion to be 73% and 83% respectively and concluded that addition of MRI to preoperative assessment led to improved preoperative assessment, triage, and treatment.[6]

Kim et al compared TVUS, CT and MRI for detection of deep myometrial invasion and found MRI to be significantly superior to other imaging modalities.[7] Zamani F et al found a diagnostic accuracy of pelvic MRI for detection of deep myometrial invasion and cervical stromal involvement of 90.74%.[8] The authors used T2 weighted and DCE MRI sequences. Their results for diagnostic accuracy in detection of deep myometrial invasion are higher than those quoted by other authors. In our study we found a diagnostic accuracy of 76% for detection of deep myometrial invasion.

Wu W et al found an overall accuracy of MRI for detecting myometrial invasion of 81.8% with significant variation between premenopausal and postmenopausal patients.[9] The authors suugested that premenopausal patients without MRI evidence of deep myometrial invasion could be offered less extensive surgery. Duncan KA et al in their national audit of MRI accuracy in staging of endometrial cancer found concordance between MRI and reference standard of histopathology in 82% for myometrial invasion, 90% for cervical and 94% for pelvic nodal involvement.[10] In current study, we found the diagnostic MRI accuracy to be 76% for myometrial invasion, 96% for cervical and 96% for pelvic nodal involvement respectively.

CONCLUSION

MRI with dedicated standard protocol sequences including T1WI, T2WI, DWI with ADC mapping and DCE MRI is the most accurate imaging modality for preoperative staging in endometrial cancer. DWI followed by ADC mapping can give significant input regarding the involvement of myometrium even in patients in whom MRI contrast is contraindicated.

Post contrast (DCE), the tumour shows enhacement and the pattern of enhancement can provide clue regarding the tumour grade which needs to be investigated by further studies. Preoperative MRI can aid in identification of patients at risk of nodal metastases in whom a thorough lymphadenectomy would be desirable. Conversely, accurate identification of patients without risk factors will enable omission of unnecessary lymphadenectomy. Identification of patients with accurately assessed myometrial invasion, with extension of disease to cervix or adnexae would help the care provider tailor the surgery as per disease extent. The study gave comparable results in our population with published western studies.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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