Diagnostic accuracy of pelvic MRI for determination of the cervical involvement in endometrial cancer

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DIAGNOSTIC ACCURACY OF PELVIC MRI FOR DETERMINATION OF THE CERVICAL INVOLVEMENT IN ENDOMETRIAL CANCER

Imrana Masroor, Sadia Rashid, Shaista Afzal, Saira Naz Sufian and Muhammad Azeemuddin

ABSTRACT

Objective: To determine the diagnostic accuracy of pelvic MRI for assessment of the cervical involvement in endometrial cancer.

Study Design: Cross-sectional analytical study.

Place and Duration of Study: Radiology Department of the Aga Khan University Hospital, Karachi from January 2014 to December 2015.

Methodology: Patients with biopsy-proven endometrial cancer were included, who had both their MRI and histopathological diagnosis performed at our institution. Those patients treated with chemo/radiotherapy or had incomplete medical records, were excluded. The extent of cervical involvement by endometrial carcinoma was seen on T2WI images, and findings were correlated after surgery taking histopathology as the gold standard. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were calculated.

Results: The mean age of the 56 patients was 60.87 ±8.80 years (range 37-84 years). The most common clinical indication was post-menopausal bleeding (n=37, 66.1%). The most common histological subtype was endometrioid adenocarcinoma (n=50, 89.3%). The sensitivity, specificity, diagnostic accuracy, positive and negative predictive values of MRI in the detection of cervical invasion were 92.85%, 88.09%, 89.28%, 72.22% and 97.36%, respectively.

Conclusion: MRI is a highly sensitive and specific imaging modality for detection of cervical invasion in endometrial carcinoma.

Key Words: Endometrial carcinoma. Cervical involvement. Magnetic resonance imaging. Diagnostic accuracy.
Thus increase survival rate.\textsuperscript{11} A study conducted by Taufig et al. reported a potential role of MRI for determining myometrial invasion.\textsuperscript{14} The data about the role of Magnetic Resonance Imaging (MRI) in staging of endometrial cancer, particularly in detection of cervical invasion in our country, is limited.

The aim of this study was to determine the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of MRI in the detection of cervical involvement by endometrial carcinoma.

**METHODOLOGY**

It was a cross-sectional analytical study conducted at the Department of Radiology, The Aga Khan University Hospital (AKUH), Karachi, Pakistan from January 2014 to December 2015. Exemption was taken for this retrospective study from Ethical Review Committee of the Hospital. The sample size was calculated using the Lin Naing sample size calculator. The sensitivity and specificity of MRI T2 weighted images (T2WI) for determination of cervical invasion has been calculated to be 100% and 95%, respectively; the reported prevalence of endometrial cancer is 6%. Therefore with a confidence interval of 95%, and a 6% error margin, the calculated sample size was 56 patients. Purposive non-probability sampling was applied. The inclusion criteria were all patients (all ages) with histology proven endometrial carcinoma on biopsy, and had their MRI pelvis for staging before hysterectomy, who then underwent surgery and histopathology at our hospital. All patients treated with radiotherapy/chemotherapy or patients with incomplete medical records were excluded. The final histological diagnoses, i.e. invasion of cervix and final staging of patients, was recorded.

Imaging protocol included all routine sequences comprising coronal T1W, axial, sagittal, coronal T2W, axial T1W fat suppressed, and sagittal T1W post-contrast with fat suppression images. T2W imaging was done by the protocol set in our department for female pelvis, with the following parameters: TR/TE 3900/76; field of view 38 cm; slice thickness 4 mm; gap 0; number of excitations 4; matrix 192x192; 3 acquisitions with 8 slices per acquisitions; and phase encoding direction, anterior to posterior. The time needed to obtain the T2W images was set to 4 minutes.

Scan reading was performed by two independent radiologists with greater than 5 years of experience in women imaging. MRI results were compared with final histopathology setting letter as gold standard. True positive was taken if abnormal signal of endometrium, i.e hyperintense to myometrium and hypointense to endometrium, was not extending into cervix and invasion of cervix not seen on histopathology. Statistical analysis was performed on SPSS (version 21.0). Mean and standard deviation were calculated for all continuous variables and frequencies with percentages were calculated for categorical ones.

Sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and accuracy were determined. Positive cases comprised true positives and false negatives; and negative cases comprised true negatives and false positives.

**RESULTS**

Fifty-six patients had a mean age of 60.87 ±8.80 years (range 37-84 years). The most common clinical indication was post-menopausal bleeding (n=37, 66.1%) followed by increased endometrial thickness on ultrasound (n=11,19.6%) and irregular vaginal bleeding in pre-menopausal patients (n=4,7.1%). The most common histological subtype was the endometrioid adenocarcinoma detected in 89.3% (n=50) of the patients.

In MRI on T2W images, endometrial carcinoma appeared heterogeneous in 23 patients (Figure 1, 41.1%); hypointense in 24 patients (42.9%); and hyperintense in nine patients (16.1%). On diffusion weighted images (DWI), 52 patients (92.9%) showed diffusion restriction and four patients (7.1%) were negative for diffusion restriction. On T1W fat sat post contrast images, 26 cases (46.4%) did not show enhancement, 25 cases (44.6%) showed mild enhancement, and five cases (8.9%) showed heterogeneous enhancement. On T2W images, cervical involvement was detected in 18 patients (32.1%); while in 38 patients (67.9%), cervical involvement was not detected.

On histopathology report, cervical involvement was detected in 15 patients (26.8%); while in 41 patients (73.2%), cervical involvement was not detected. A total of 13 out of 18 patients (72.2%), who showed cervical invasion on the T2W MRI (Figure 2), turned out to be positive on histopathology (true positive) and 5 out of 18...
Endometrial carcinoma is a common gynecologic malignancy that affects women of reproductive age. It is characterized by the growth of cancerous cells in the lining of the uterus (endometrium) and is most commonly detected in postmenopausal women, who present with symptoms such as irregular vaginal bleeding, post-menopausal bleeding, or abnormal endometrial thickening.

### DISCUSSION

There are various imaging modalities such as ultrasound and computed tomography (CT) scan available for the assessment of endometrial carcinoma but MRI gives far more information with regard to its extent which helps in treatment planning and determining prognosis.

Transvaginal ultrasound (TVUS) is a rapid, low-cost, non-ionizing modality often used as a first imaging in initial workup of women with complaint of post-menopausal bleeding. Endometrial carcinoma is typically visualised as thickening of the endometrial lining, and TVUS is used to measure this thickened endometrial lining in the antero-posterior diameter, to assess preoperatively, the myometrial and cervical extension of endometrial carcinoma with multi-detector CT showed better diagnostic accuracy of 95% and 81%, respectively. CT shows less sensitivity and specificity in correctly determining myometrial involvement and cervical invasion as opposed to MRI. Therefore, it appears to have a limited role in local staging due to its suboptimal soft tissue delineation. The sensitivity and specificity of CT in determining myometrial involvement ranges from 40% to 83% and 42% to 75%, respectively. Recent studies done to assess preoperatively, the myometrial and cervical extension of endometrial carcinoma with multi-detector CT showed better diagnostic accuracy of 95% and 81%, respectively. At present, CT is used generally in the assessment of advanced stage disease, i.e. for evaluating patients with endometrial carcinoma by determining nodal and distant metastases.

MRI achieves the greatest accuracy, for pre-treatment local staging of endometrial cancer, mainly due to its superb soft tissue delineation. On MRI, endometrial carcinoma is usually detected as a hypo-to-isointense mass on T1WI, showing intermediate signal intensity less than the normal endometrium on T2WI. In post-contrast dynamic imaging, endometrial carcinoma enhances a lesser amount than the myometrium. On the whole, staging accuracy of MRI is reported to be 83-92%. The usual signal of normal cervical stroma on T2WI is low, this becomes distinct to the high-intermediate signal intensity of tumor infiltration. The sensitivity, specificity, and diagnostic accuracy of MR in determination of cervical infiltration have been reported to be 100%, 87%, and 90%, respectively and on T2WI 100%, 95%, and 96%, respectively.

In this study, most of the patients were post-menopausal and presented with post-menopausal bleeding. Endometrial carcinoma was detected on T2WI, DWI as well as on T1W fat sat post contrast images but cervical invasion was best detected on T2WI with diagnostic accuracy approaching 89.28%.

In a study conducted by Zamani et al., the sensitivity and specificity in cervical stromal infiltration was higher in distinction to mucosal infiltration, 54.54% and 100% vs. 71.4% and 97.5%, respectively. In another study conducted by Seki et al., the overall accuracy of MRI in predicting cervical infiltration was determined to be 90-92%, with sensitivity of 75-80% and specificity of 94-96%.

This study shows the sensitivity and specificity for cervical stromal involvement as 92.85% and 88.09%, respectively. The sensitivity of this study was higher than studies conducted by Zamani et al. and Seki et al. probably because of the larger sample size.

MRI's greater soft tissue delineation allows it to be a superior than other cross-sectional imaging modalities in determining adnexal metastases, invasion of vagina, and presented with post-menopausal bleeding.

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MRI's greater soft tissue delineation allows it to be a superior than other cross-sectional imaging modalities in determining adnexal metastases, invasion of vagina,
urinary bladder, and rectum. It is thought that with the new 2009 FIGO staging system, an improved accuracy in MRI staging is obtained.\textsuperscript{24,25}

The main limitation of this study was the inter-observer agreement between the two consultants, which was not taken into account. Furthermore, the patients who underwent curettage before MRI were not excluded from this study; thus the imaging performed after cervical curettage may result in abnormal signal intensity, replacing the normal hypointense signal intensity of cervix.

**CONCLUSION**

At present, MRI is an accurate, sensitive and specific modality for cervical invasion of endometrial carcinoma.

**REFERENCES**


