

**Role of Magnetic Resonance Imaging (MRI) in the Depicting Depth of Myometrial Infiltration in Patients with Endometrial Carcinoma: A Prospective Study**

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**Abstract**

**Background:** Magnetic Resonance Imaging (MRI) is considered important tool in the diagnosis of endometrial cancer. The present study aimed to evaluate the role of MRI in the depicting depth of myometrial infiltration in patients with endometrial carcinoma.

**Materials and Methods:** This study was conducted in the department of Radiodiagnosis, Government Medical College, Trivandrum, Kerala. A total of 55 patients were included in the study on the basis of inclusion and exclusion criteria. They were subjected to MRI for the evaluation of myometrial infiltration. The data was expressed in number, percentage, mean and standard deviation. Statistical Package for Social Sciences (SPSS 16.0) version used for analysis.

**Results:** Total of 55 patients included in the study. 4 were lost follow up, finally 51 patients were observed and analyzed. Maximum patients were age between 60-64 years. 90.20% were postmenopausal bleed. 100.00% were iso-intense in T1W imaging and 45 hyperintense SI in T2W imaging. 84.3% patients showed tumor not

confined to endometrium. 37 showed less than 50% and 14 showed more than 50% invasion of myometrium.

**Conclusion:** MRI is one of the valuable tools to detect the myometrium infiltration in patients with endometrial carcinoma.

**Keywords:** Carcinoma, MRI, Cervix, Endometrium, Infiltration, Myometrium

**Introduction**

Worldwide, endometrial carcinoma is the seventh most common malignant disorder, but incidence varies among regions<sup>1</sup>. In less developed countries, risk factors are less common and endometrial cancer is rare, although specific mortality is higher<sup>2</sup>. The incidence is ten times higher in North America and Europe than in less developed countries; in these regions, this cancer is the commonest of the female genital tract and the fourth commonest site after breast cancer, lung, and colorectal cancer. The incidence is rising as life expectancy increases<sup>3</sup>. The typical age incidence curve for endometrial cancer shows that most cases are diagnosed after the menopause. Factors increasing risk of endometrial carcinoma include increasing age, long-

term exposure to unopposed oestrogens, high concentrations of oestrogens, postmenopausally, metabolic syndrome, years of menstruation, nulliparity, history of breast cancer, long-term use of tamoxifen and first-degree relative with endometrial cancer etc<sup>4</sup>. The value of transvaginal ultrasound in symptomatic premenopausal women and that using hormone replacement therapy is lower because the “normal” endometrial thickness varies with circulating concentrations of female steroid hormones. A Pap smear is only of value when it is abnormal. A normal result is not sufficient to exclude endometrial cancer in symptomatic women and an abnormal result frequently points to advanced disease<sup>5</sup>. Magnetic resonance (MR) imaging has proved accurate in the assessment of the depth of myometrial infiltration by endometrial carcinoma and has higher accuracy than other imaging modalities, such as sonography and computed tomography (CT)<sup>6,7</sup>. With this background the present study aimed to evaluate the role of MRI in depicting depth of Myometrial infiltration in patients with endometrial carcinoma.

## Materials and Methods

**Study settings:** This study was done in the Department of Radiodiagnosis. Government Medical College, Trivandrum, Kerala. It is a prospective study and it was ethically cleared by Institutional Human Ethics Committee (IHEC).

## Inclusion criteria

- HPR proven endometrial adenocarcinoma
- Undergoing surgery
- Willing to give consent form

## Exclusion criteria

- High risk patients
- Surgery cannot be done
- Already undergone surgery

- Undergone radiotherapy

## Procedure

Based on the inclusion and exclusion criteria a total of 55 patients were included in the study. All the study population was explained details of study procedure. Informed consent was obtained from each patient. Demographic and clinical data was recorded in the case sheet. Before doing the MRI scan patients are instructed to fast for 4–6 hours to limit artifact due to small-bowel peristalsis and asked to empty the bladder before going on the MRI scanner. A full bladder may degrade T2-weighted images because of ghosting and motion artifacts. Patients are imaged in the supine position. Imaging is done in the 1.5 tesla MRI scanner in our department. The MRI results were recorded and analyzed.

## Statistical analysis

The data was expressed in number, percentage, mean and standard deviation. Statistical Package for Social Sciences (SPSS 16.0) version used for analysis. Micro soft excel sheet 2009 used for making the graphs.

## Results

The study included total 55 patients. In that 4 patients were lost follow up. Maximum number of patients had age between 60-64 Y (n=21) followed by 65-69 Y (n=14). 2 patients had age between 45-49Y (Table-1). 46 patients had postmenopausal bleed, 3 had intermenstrual bleed and 2 had post coital bleed (Graph-1). In T2W images the lesion appeared hyper intense in 45/51 patients ie 88.2% of patients. In one case the lesion appeared hypointense and in 5% cases the lesion appeared isointense. In such cases the involvement of myometrium could not be well evaluated in T2WI. As the lesion is hyperintense in most of the cases the evaluation of myometrial invasion was better in T2W images (Table-2). The correlation of

MRI report and histology showed similar results with sensitivity (71.20%) and specificity (93.18%) (Table-3). 72.50 % showed less than 50% invasion which is similar to histology report (Table-4). Only 14 patients showed more than 50 invasion and histology reports showed slight difference without significant. MRI and histopathology reports correlation showed 71.20% sensitivity with 93.18% specificity.

### Discussion

The study included 55 patients but 4 patients discontinued from the study. 51 patients were completed the study. In this study majority of the patients (68.00%) comes under the age group 60-69 years, followed by 55-59 years coming upto 11.80%. According to histopathology report 80.00% of patients had endometriod type of adenocarcinoma. Next common subtype being pap serous adenocarcinoma. Similar findings are given in literature as given by Salaet.al., in a journal published in AJR. Adenocarcinomas arise from the uterine epithelium and constitute 90.00% of endometrial cancers<sup>8</sup>.90% of patients presented with postmenopausal bleeding in the present study. In a study by Franco Zandrinoet.al., in Italy showed that 87.00% were postmenopausal<sup>9</sup>. The presenting symptoms were postmenopausal abnormal bleeding in 80.00%, mucinous vaginal discharge in 10.00%, and intermenstrual dysfunctional bleeding in 10.00% patients. On analysing the signal intensity changes, in all the cases tumour was isointense in T1W images. So T1W images were less effective in early staging of endometrial carcinoma. In T2W images the lesion appeared hyper intense in 88.2% of cases. In 5 cases the lesion appeared isointense. In one patient the lesion appeared hypointense. Diagnostic criteria for myometrium invasion include irregular endometrium-junctional zone interface at T2-weighted and contrast

enhanced T1-weighted images or interruption of the junctional zone<sup>4</sup> and at dynamic contrast enhanced T1-weighted sequences the inner myometrial layer enhances earlier and more intensely than the outer myometrial layer. Myometrial invasion can be diagnosed due to the interruption or loss of early normal sub-endometrial enhancement even in postmenopausal woman<sup>5</sup>. Out of the 51 patients studied 16 patients ie 31% of patients were in stage 1B d/s which was most common,15.7% patients were in stage 1A d/s and 10% patients had deep myometrial invasion.25% patients had lymph node involvement and 17.6% had cervical involvement.

On evaluation of tumour confined to the endometrium ie stage 1A d/s true positives are 5 cases, true negative cases are 41 and 3 cases were misinterpreted as confined to endometrium ie the 3 cases were understaged. Similarly 2 cases were misinterpreted as having myometrial invasion when they were actually confined to endometrium ie, these two cases were overstaged. The overstaging in MRI was mainly because of the indistinct junctional zone and thin myometrium in postmenopausal age group. And 2 cases were understaged as having <50% myometrial invasion when they actually had >50% myometrial invasion.1 patient was overstaged as >50% myometrial invasion when the patient had only <50% myometrial involvement in HPR. In our study MRI is found to be 97.05% sensitive in determining less than 50% involvement of myometrium. It is less specific in determining the <50% myometrial invasion- ie76.47%.PPV-89.19%,NPV-92.86%,Accuracy-90.02% Positive likelihood ratio-8.25,Negative likelihood ratio-0.077. In a study by EvisSalaet.al., published in AJR women's imaging they concluded that the sensitivity and specificity of MRI in the

assessment of the depth of myometrial invasion range from 69% to 94% and from 64% to 100%, respectively. On statistical analysis of >50% myometrial invasion, out of 17 patients who were truly positive 14 were detected by MRI. 4 cases were false negative. From our study it was concluded that the sensitivity of MRI in determining >50% involvement was 76.4% and specificity 97%. PPV-92.86%, NPV-89.19%, Accuracy-90.19%. Positive likelihood ratio-13, Negative likelihood ratio-0.12. In a study by Riccardo Manfredi et al., published in radiology the myometrial infiltration was correctly assessed in 84% patients, was underestimated in four (11%) patients, and was overestimated in two (5%) patient. In the study by Fatima Mubarak et al., MRI accurately staged presence of myometrial invasion in 39 (78%) and absence of myometrial invasion in 5 (10%) out of 50 patients. 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.

In another study by Franco Zandrino et al., they concluded that for deep myometrial infiltration T2-weighted sequences reached a sensitivity of 85%, specificity of 76%, PPV of 73%, NPV of 87%, and accuracy of 80%, while contrast-enhanced scans reached a sensitivity of 90%, specificity of 80%, PPV of 82%, NPV of 89%, and accuracy of 85%<sup>11</sup>. In a study to stage endometrial carcinoma by MRI by Fatima Mubarak et al they concluded that tumour signal intensity on T1- and T2-weighted images when 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 could help in better evaluation of myometrial infiltration<sup>10</sup>. The present study showed the 71.20% sensitivity and 93.18% specificity in the diagnosis of myometrial infiltration. Pietro T et al., study also showed similar type of sensitivity and specificity<sup>11</sup>. This study results showed that MRI is more useful tool for the detection of endometrial infiltration patients with endometrial carcinoma.

### Conclusion

MRI plays major role in the diagnosis of diseases. In the present study MRI showed more significant sensitivity and specificity in the detection of depth of myometrial infiltration in patients with endometrial carcinoma. MRI will be helpful for physician to understand the disease pathology and treat with lesser mortality rate.

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**Legend Tables and Figures**

Table 1: Distribution of patients based on the age

Age (Years)	Number (n=51)	Percentage (%)
45-49 Y	2	3.90
50-54 Y	3	5.90
55-59 Y	6	11.80
60-64 Y	21	41.20
65-69 Y	14	27.50
>70 Y	5	9.80

Graph 1: Distribution of patients based on the clinical symptoms

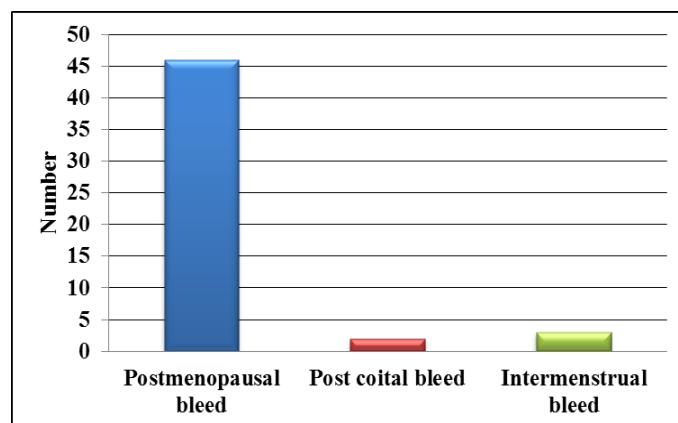


Table 2: Distribution of SI in T2W image

SI in T2W image	Number (n=51)	Percentage (%)
Hyper	45	88.20
Hypo	1	2.00
Iso	5	9.80

Table 3: Comparison of tumor confined to endometrium reports of MRI and histopathology

Observation	Tumor confined to endometrium by MRI		Tumor confined to endometrium by Histopathology		Sensitivity (%)	Specificity (%)
	Number	Percentage (%)	Number	Percentage (%)		
Yes	8	15.70	7	13.70	71.20	93.18
No	43	84.30	44	86.30		

Figure 1: Stage 1A disease tumor confined to the endometrium-T1W post contrast image

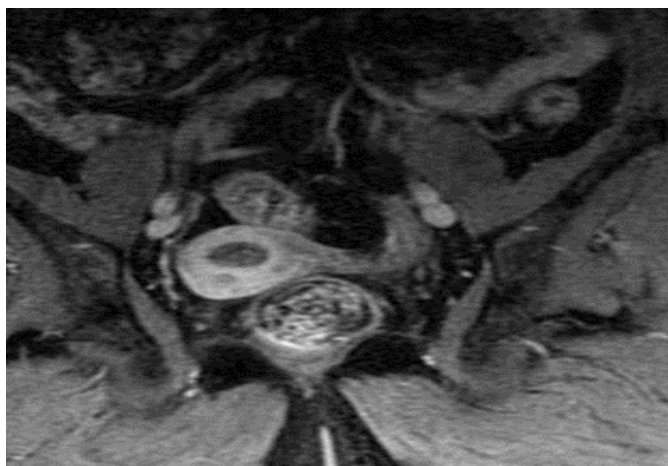


Figure 4: Post contrast coronal image showing < 50% involvement



Figure 2: T2W sagittal images showing tumor invading the myometrium well seen in the anterior wall. Stage 1B d/s as evidenced by indistinct tumor myometrial interface

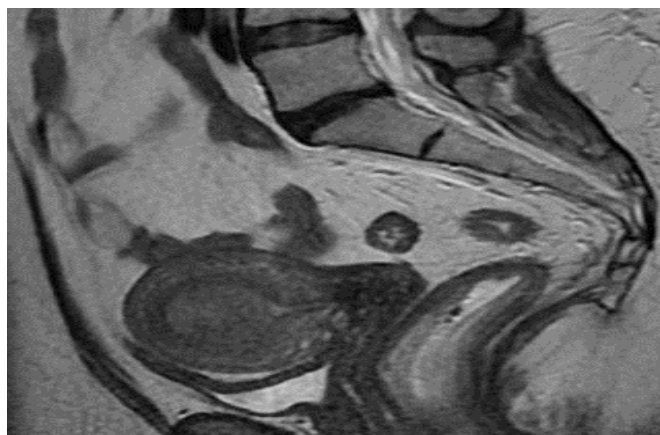


Figure 5: STIR sag image showing suspicious involvement of >50% myometrium



Figure 3: Post contrast images of the same patient showing myometrial invasion stage 1B d/s



Figure 6: Sag T2W images showing tumour with myometrial invasion, appears to be more than 50% involvement. Here myometrium appears thin

