

ARTICLE



Influence of Age on Tumour Grade and Myometrial Invasion in Endometrial Cancer: Assessment by Magnetic Resonance Imaging and Histopathology

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ABSTRACT

Background: Advanced age is a significant risk factor for aggressive Endometrial Cancer (EC). Myometrial invasion must be precisely diagnosed and evaluated preoperatively to make plan of the surgical procedure and optimize the prognosis. Histopathology is the confirmatory investigation to assess depth of myometrial invasion and tumour grade. **Aim:** The objective was to determine how age affects tumour grade and myometrial invasion in endometrial cancer, as well as to evaluate MRI accuracy in detecting preoperative myometrial invasion. **Materials and Methods:** This was a part of a large cross-sectional analytical study was conducted from January 2022 to December 2022. Purposive sampling was used to include 50 referred patients with biopsy-confirmed endometrial cancer in the Department of Gynaecological Oncology of BSMMU and NICRH. All patients provided written informed consent for the collection and processing of their data for scientific purposes and the patients were informed about the goal of the study. MRI was used to assess myometrial invasion preoperatively. **Results:** A total of 52% participants were in 51-60 years age group. The association between age with grade of tumour and deep myometrial invasion were (in MRI and histopathology) significantly associated ($p < 0.05$ in patients aged 51-60 years old). MRI findings confirmed 23 (46%) and 27 (54.0%) patients had superficial and deep invasion respectively. The sensitivity, specificity, accuracy, PPV and NPV of MRI to detect myometrial invasion were 91.3%, 77.8%, 84.0%, 77.8%, and 91.3% respectively. **Conclusion:** The influence of age on tumour grade and deep myometrial invasion were found significant in patients aged 51 to 60 years, as observed in both MRI and histopathology. Evaluating myometrial invasion is crucial for preoperative staging of EC.

Keywords: Older Age, Magnetic Resonance Imaging, Endometrial cancer, Preoperative evaluation, Gynaecological Oncology, Cancer staging

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INTRODUCTION

Endometrial cancer (EC) is the most common gynaecologic malignancy of industrialized nations [1,2].

It affects mainly postmenopausal women, with the mean age at diagnosis 68 years [3]. Most patients have a good prognosis, but it is compromised in several conditions:

one of the major conditions is advanced age, another one—obesity; the 5-year overall survival is 76% [4]. It was established that older patients, on presentation, mostly have high-grade tumours, aggressive features with deep myometrial invasion, involvement of the lower uterine segment, and advance disease stages [5]. The rates of recurrence and mortality for women diagnosed with EC of advanced age increase. Advanced age among women with endometrial cancer contributes to worse characteristics of the disease and fewer opportunities for surgical treatment; their outcomes are poorer [6]. Magnetic resonance imaging is important in the assessment of myometrial invasion in patients with EC. This imaging modality yields detailed information that is essential in clinical decision-making in respect to treatment options and surgical approaches [7]. MRI techniques with a multi-faceted approach can present an exceptionally detailed review of myometrial invasion, taking into consideration tumour architecture and function. MRI findings and their histopathological results have been largely correlated in research studies, thereby enhancing accuracy for the preoperative staging and helping in treatment planning impressively [8,9]. Histopathology has also been shown to demonstrate remarkable predictive performances in several studies, especially in the evaluation of deep myometrial invasion; it has achieved AUC values as high as 0.973, which proves that this method has great potential for detecting invasion depth [10]. As MRI has been reported to show sensitivities and specificities greater than 88% and, thus, to represent useful tools in the preoperative assessment of endometrial cancer [9], they improve the diagnostic accuracy of MRI and, hence, the detection rate of both superficial and deep myometrial invasions. Limitations regarding myometrial invasion in EC need to be considered as, should this be suspected, there is a risk of false positives which would lead to overly aggressive treatment strategies not necessary in the case of non-

aggressive disease [11]. Considering this, further research and clinical validation would be warranted in an attempt to maximally increase the benefits of MRI while at the same time decrease the risks of misdiagnosis. The study will help in finding the influence of age on the grade and myometrial invasion of the tumour. It will also help to find the diagnostic accuracy of MRI in assessing myometrial invasion compared to histopathology.

MATERIALS AND METHODS

Study Design

A part of large cross-sectional analytical study involved 50 patients diagnosed with endometrial cancer at Bangabandhu Sheikh Mujib Medical University and the National Institute of Cancer Research & Hospital in Dhaka from January to December 2022. Patients receiving preoperative chemotherapy or radiotherapy were excluded. Informed consent was obtained, and data were collected through interviews using a semi-structured questionnaire. The study utilized MRI for assessing myometrial invasion, classifying it as confirmed to endometrium or < 50% (superficial) and or ≥50% (deep) invasion. MRI techniques, including T2-weighted imaging, DCE-MRI, and DWI-MRI, were also employed. Surgical management varied from staging for high-risk patients to total abdominal hysterectomy for low-risk individuals, with specimens sent for histopathological evaluation, conducted independently of MRI results.

Statistical analysis

Statistical analysis using SPSS software version 25 calculated the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of MRI findings compared to histopathological results. Ethical clearance was obtained from the Institutional Review Board of BSMMU and NICRH, with informed consent secured from all participants.

RESULTS

Table 1: Demographic characteristics of the study participants (n=50)

Attributes	Frequency	Percent
Age (years)		
23-50	6	12.0
51-60	26	52.0
61-70	18	36.0
Mean±SD=57.9±8.2		

Duration of Illness		
≤ 5 months	32	64.0
>5 months	18	36.0
Mean±SD =5.04±2.31		
BMI (kg/m ²)		
18.5-24.9	15	30.0
25.0-29.9	35	70.0
Mean±SD=25.4±1.7		

Table 1 states that majority 26 (52.0%) patients belonged to the age group 51-60 years and 35 (70.0%) patients were overweight (25.0-29.9 kg/m²). The

Mean±SD of duration of illness and BMI (kg/m²) were 5.04±2.31 months and 25.4±1.7 respectively.

Table 2: Histopathological characteristics and distribution of myometrial invasion of study participants by MRI and histopathological findings (n=50)

Attributes	Frequency	Percentage
Histopathological tumour grade		
Grade I	16	32.0
Grade II	24	48.0
Grade III	10	20.0
Myometrial invasion	MRI	Histopathology
Confined within endometrium		
No invasion or <50% invasion (superficial)	23 (46%)	27 (54%)
>50% invasion (deep)	27 (54%)	23 (46%)

Table 2 explains that histopathological tumour grade, majority 24 (48.0%) patients had grade II, 16 (32.0%) had grade I and 10 (20.0%) had grade III tumour. Regarding MRI findings, 23 (46%) patients had superficial invasion and 27 (54.0%) patients had deep

invasion. Regarding histopathological findings which is the gold standard for comparison with MRI, in 27 (54%) patients had superficial invasion and in 23 (46.0%) patients had deep invasion.

Table 3: Association of histological Grade with demographic characteristics of the study participants (n=50)

Histological Grade	Age (years)			Family member suffered		Duration	
	23-50	51-60	61-70	Yes	No	≤ 5 months	>5 months
Grade 1	0 (0.0%)	10 (62.5%)	6 (37.5%)	2 (12.5%)	14 (87.5%)	11 (68.8%)	5 (31.3%)
Grade 2	2 (8.3%)	12 (50.0%)	10 (41.7%)	4 (16.7%)	20 (83.3%)	14 (58.3%)	10 (41.7%)
Grade 3	4 (40.0%)	4 (40.0%)	2 (20.0%)	1(10.0%)	9 (90.0%)	7 (70.0%)	3 (30.0%)
Significance	0.036			0.859		0.723	

Chi-square test was conducted to find out the significance, $p < 0.05$ was considered significant

Table 3 states that 12 (50%) and 10 (41.7%) patients aged 51-60 years had grade 2 tumour histologically; 4 (16.7%) of them had positive family

history and they suffered from 10 (41.7%) for >5 months. The association between age and grade of tumour found significantly associated ($p=0.036$).

Table 4: Association of age with histopathological Myometrial Invasion of the study participants (n=50)

Attributes		Age (years)		
		23-50	51-60	61-70
Histopalogical Myometrial Invasion	No invasion or <50% invasion (superficial)	6 (22.2%)	12 (44.4%)	9 (33.3%)
	>50% invasion (deep)	0 (0.0%)	14 (60.9%)	9 (39.1%)
Significance		0.04		
MRI Myometrial Invasion	No invasion or <50% invasion (superficial)	5 (21.7%)	12 (52.17%)	6 (26.0%)
	>50% invasion (deep)	1 (3.7%)	14 (51.9%)	12 (44.4%)
Significance		0.035		

Chi-square test was conducted to find out the significance, $p<0.05$ was considered significant

Table 4 shows that 60.9% (by histopathologically) and 51.9% (by MRI) deep myometrial invasion found in patients aged 51-60 years old ($p=0.04$, $p=0.035$)

Table 5: Validity of MRI findings in the evaluation of myometrial invasion (deep) comparing with histopathology findings

MRI findings (Myometrial invasion)	Histopathological findings (Myometrial invasion)	
	>50% invasion (deep)	No invasion or <50% invasion (superficial)
>50% invasion (deep) (n=27)	21 (True positive=TP) 91.3% (Sensitivity)	6 (False positive=FP) 22.2%
Confined to endometrium or <50% invasion (superficial) (n=23)	2 (False negative=FN) 8.7%	21 (True negative=TN) 77.8% (Specificity)
Total 50	23 (TP+FN)	27 (FP+TN)

Test of Validity (MRI vs. Histopathology)

- Sensitivity = 91.3%
- Specificity = 77.8%
- Accuracy = 84.0%
- Positive Predictive Value (PPV) = 77.8%
- Negative Predictive Value (NPV) = 91.3%

Table 5 reveals that patients who had deep myometrial invasion confirmed by histopathology, among them 21 (91.3%) had deep invasion and 2 (8.7%) had superficial invasion according to MRI findings. So, the true positive cases are 91.3% which is the sensitivity

of the test which means, the ability of MRI is 91.3% to detect true positive cases. Patients who had superficial myometrial invasion confirmed by histopathology, among them 6 (22.2%) had deep invasion and 21 (77.8%) had superficial invasion according to MRI findings. So, the true negative cases are 77.8% which is the specificity of the test which means, the ability of MRI is 77.8% to detect true negative cases. Detection of Myometrial invasion by MRI accuracy was 84.0%.

DISCUSSION

In the current study, the age group of 51-60 years consisted of 52.0% of the patients, with the mean age being 57.9±8.2 years. A study reported similar findings with the mean age as 57.27 years, while 23.3% of the patients less than 50 years manifested features of endometrial carcinoma [12]. Another survey presented that 51.51% were aged 60-69 and Wong *et al.*, 2022 found a median age of 66 years, consistent with this study [13,15]. The present study observed that age was significantly associated to tumour grade and myometrial invasion. As many as 12 (50%) and 10 (41.7%) patients aged 51-60 years had grade 2 tumour histologically ($p=0.036$) and 14 (60.9%) deep myometrial invasions found in patients aged 51-60 years old ($p=0.04$). It was observed that advanced age is a significant risk factor which increases the chances of the recurrence of endometrial cancer [15]. In the present study, majority 35 (70.0%) patients were overweight (25.0-29.9 kg/m²). This finding correlates with the findings of another survey which found endometrial cancer (EC) is strongly associated with obesity, particularly abdominal obesity, which is a modifiable risk factor. Higher obesity rates are linked to an increased incidence of EC [16]. In the present study, regarding MRI findings, 23 (46%) patients had no invasion or superficial invasion and 27 (54.0%) patients had deep invasion. Mohamed *et al.* (2018) reported no myometrial invasion in 26.7%, <50% invasion in 20.0% and >50% invasion in 53.3% of patients in MRI findings which is similar to this present study [12].

In this study, 27 patients had evidence of deep invasion on MRI, which was confirmed by histopathology to be 21 true positives and 6 false positives. Then, 23 patients were diagnosed to have either endometrial or superficial invasion on MRI and thus had 21 true negatives and 2 false negatives. Out of the 11 patients with cervical extension, 9 were true positives, and 2 were false positives; out of 39 without cervical extension, 1 presented as a false negative, while 38 were true negatives. The current study investigated that the sensitivity of the MRI test was 91.3% with 84.0% accuracy. Buonomo *et al.* (2020) assessed MRI for myometrial invasion in 136 women; 79 (58%) of them presented more than 50% myometrial infiltration [17]. The MRI correctly predicted invasion in 80.3% of cases, detecting deep invasion in 57 of 70 patients (81.4%). The sensitivity of

MRI was 81.4%, with a specificity of 78.8%. Ultrasound had a higher sensitivity for the level of infiltration of 89.7%, but its specificity was similar, being 73.3%. These findings are in keeping with previous studies [12,18]. This study had a number of limitations since it was conducted in two tertiary hospitals that are located in Dhaka and thus cannot be generalized to the wider population of the country. This study also has other limitations such as cross-sectional study design and small sample size.

CONCLUSION

The influence of age on tumour grade and deep myometrial invasion were found significant in patients aged 51 to 60 years, as observed in both MRI and histopathology. An efficient technologist using a high-resolution MRI machine can effectively assess myometrial invasion.

Declarations

Ethics approval and consent to participate
Before data collection, all ethical issues were maintained.

Consent for publication

All authors have approved this manuscript for publication.

Availability of data and materials

The datasets supporting the conclusions of this article are included within the article generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

SA, FE, KRS participated in the design of the study, data interpretation and drafted the manuscript. SA, MSA, KRS, MP contributed to the data design, data interpretation and data analysis and critical review of the manuscript. All authors read and approved the final manuscript.

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