

Original article:

Study of evaluation of role of MRI in cervical malignancies

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Abstract:

Background: Cervical cancer is a significant health burden, and accurate staging is crucial for optimal treatment planning. Magnetic resonance imaging (MRI) has emerged as a valuable tool in the evaluation of cervical malignancies due to its excellent soft tissue contrast and multiplanar imaging capability.

Methods: A descriptive correlational study was conducted over a two-year period on 40 patients with known cervical lesions. Patients were evaluated with MRI, and the findings were correlated with ultrasonography. The staging of cervical cancer was based on MRI findings using the FIGO classification. Signal intensity characteristics and specific MRI findings were analyzed, including post-contrast enhancement, uterine invasion, vaginal invasion, tumor extension to adjacent pelvic organs, lymph node involvement, and distant metastasis.

Results: The majority of patients presented with advanced-stage cervical cancer, with stage IV being the most prevalent (65% of cases). The signal intensity characteristics on MRI showed that most lesions were T1 hypointense (57.5%) and T2 hyperintense (67.5%). Post-contrast enhancement was observed in 90% of cases. Uterine invasion was present in 77.5% of cases, while vaginal invasion was found in 32.5% of cases. Tumor extension to adjacent pelvic organs was seen in 80% of cases. Pelvic lymph node involvement was observed in 57.5% of cases, whereas para-aortic lymph node involvement was rare (5%). Distant metastasis was detected in 5% of cases.

Conclusion: MRI plays a crucial role in the staging and evaluation of cervical cancer. The majority of patients presented with advanced-stage disease, emphasizing the importance of early detection and improved screening efforts. Signal intensity characteristics and specific MRI findings provide valuable information for treatment planning and prognostic assessment. Optimizing the utilization of MRI in the evaluation of cervical cancer can improve patient outcomes and contribute to the overall management of this significant health burden.

Keywords: cervical cancer, magnetic resonance imaging, MRI

Introduction:

Cervical malignancies, including cervical cancer, represent a significant global health burden, particularly affecting women. According to the World Health Organization (WHO), cervical cancer is the fourth most common cancer in women worldwide, with approximately 570,000 new cases and 311,000 deaths reported each year. Early detection and accurate staging of cervical malignancies are crucial for optimal treatment planning and improved patient outcomes.^{1,2}

Medical imaging plays a fundamental role in the evaluation and management of cervical malignancies. While several imaging modalities are available, magnetic resonance imaging (MRI) has emerged as a valuable tool due to its excellent soft tissue contrast, multiplanar imaging capability, and ability to provide detailed anatomical information. MRI offers several imaging sequences that allow for the evaluation of both primary tumors and regional lymph nodes, aiding in the assessment of disease extent, tumor invasion, and lymph node involvement.³ The role of MRI in cervical malignancies has evolved over the years, with advancements in imaging techniques and protocols. It has become an integral part of the diagnostic workup, staging, and treatment planning for

patients with cervical cancer. MRI provides essential information for surgical decision-making, including the identification of locally advanced disease, parametrial involvement, and tumor size. Furthermore, it aids in determining the suitability of patients for fertility-sparing treatments and assists in the evaluation of treatment response and post-treatment surveillance.^{4,5,6}

In this study, we aim to evaluate the role of MRI in cervical malignancies comprehensively. We will review the existing literature, analyze the advantages and limitations of MRI in cervical malignancies, and explore its impact on clinical decision-making. By understanding the strengths and weaknesses of MRI in this context, we can enhance its utilization and contribute to the development of standardized imaging protocols and guidelines for cervical cancer management.^{7,8}

The findings of this study will not only contribute to the existing body of knowledge but also provide clinicians and radiologists with valuable insights into the optimal use of MRI in the evaluation of cervical malignancies. Ultimately, this research may lead to improved patient outcomes, enhanced treatment planning, and the potential for earlier detection of cervical cancer, thus positively impacting the overall prognosis for affected individuals.

Study Methodology:

A descriptive correlational study design was employed to evaluate the role of MRI in cervical malignancies conducted at KIMS (DU) Karad. The study population consisted of 40 patients with known cervical lesions who were referred or attended the hospital's outpatient department (OPD), admitted as inpatients, or walked in, meeting the inclusion criteria.

Inclusion criteria for the study were as follows: patients with a clinical suspicion of cervical malignancy based on symptoms such as irregular vaginal bleeding or unexplained pain in the lower abdomen or pelvic region, patients with a known pelvic mass or cervical pathology, patients who had previously undergone biopsy, surgery, or chemo-radiation, and patients with tumor recurrence after resection.

On the other hand, patients were excluded if they did not have any known or suspected cervical pathology, if their ultrasonography examination was deemed unsatisfactory or incomplete, if they were unwilling to undergo ultrasound examination, or if they declined to undergo MRI examination.

The data collection process involved the evaluation of patients using both MRI and ultrasonography. All patients underwent a comprehensive MRI examination using appropriate imaging sequences, focusing on primary tumor evaluation, assessment of tumor invasion, and evaluation of regional lymph nodes. The MRI findings were then correlated with the ultrasonography findings, which were performed by experienced radiologists using standardized protocols.

The collected data included demographic information, clinical characteristics, imaging findings from both MRI and ultrasonography, and histopathological results when available. Data analysis was performed using appropriate statistical methods, including descriptive statistics and correlation analysis, to assess the relationship between MRI and ultrasonography findings in cervical malignancies.

Ethical considerations were upheld throughout the study, with informed consent obtained from all participants. Patient confidentiality and privacy were maintained, and the study adhered to the principles outlined in the Declaration of Helsinki.

The study findings provide valuable insights into the role of MRI in cervical malignancies, specifically in correlation with ultrasonography findings. The results contribute to the existing body of knowledge and may

have implications for clinical decision-making, treatment planning, and the overall management of patients with cervical lesions.

Results:

Table 1: Cervical cancer staging-based on MRI findings

	Cervical cancer stage	Frequency	Percentage	
1	Ca cervix stage IA1	2	5.0%	Stage I- 4
2	Ca cervix stage IA2	1	2.5%	
3	Ca cervix stage IB3	1	2.5%	
4	Ca cervix stage IIA2	1	2.5%	Stage II- 3
5	Ca cervix stage IIB	2	5.0%	
6	Ca cervix stage IIIA	1	2.5%	Stage III- 4
7	Ca cervix stage IIIC1	2	5.0%	
8	Ca cervix stage IIIC2	1	2.5%	
9	Ca cervix stage IVA	23	57.5%	Stage IV- 26
10	Ca cervix stage IVB	3	7.5%	
11	Endometrial carcinoma	1	2.5%	
12	Non-malignant	2	5.0%	
	Grand Total	40	100%	

Cervical cancer staging was done as per FIGO classification based on MRI findings. In our study, maximum number of patients presented in advanced stages of cervical ca- stage IV, with total of 26 patients. Of these around 23 (57.5%) patients were classified as stage IVA and the rest as stage IVB. There were similar presentations in stage I and stage III with 4 (10%) patients in each stage. There were 3 patients who were categorized as stage II.

Table 2: Signal intensity on MRI for cervical cancer lesions

	Hypointense	Hyperintense	Isointense	Heterogenous	Total
T1 sequence	23	0	13	3	39
T2 sequence	1	27	2	9	39
STIR sequence	1	30	0	8	39

Patients underwent MRI abdomen and pelvis for the staging of cervical cancer. The signal intensities on different sequences were noted. Most lesions were noted to be T1 hypointense with 23 cases and T2 hyperintense with 27 cases and about 30 cases showed hyperintensity on STIR sequences.

Table 3: MRI findings of cervical cancer

Findings	Present		Absent	
	N	%	N	%
Post contrast enhancement	36	90%	4	10%
Uterine invasion	31	77.5%	9	22.5%
Vaginal invasion	13	32.5%	27	67.5%
Tumour extension to adjacent pelvic organs	32	80%	8	20%
Pelvic lymph nodes	23	57.5%	17	42.5%
Para aortic lymph nodes	2	5%	38	95%
Distant metastasis	2	5%	38	95%

The MRI findings were divided as per invasion of adjacent structures and metastasis which affects the staging for tumors. In our study about 90% lesions showed post contrast enhancement. Uterine invasion was noted in 77.5% cases. Vaginal invasion was less commonly noted with only about 32.5% cases having this issue. Tumour extension to pelvic structures other than the ones mentioned above (ureter, vesico-ureteric junction, ovaries) was seen in 80% cases. Pelvic lymph node involvement was seen in 57.5% cases whereas para-aortic lymph node involvement was in only 2 cases. Distant metastasis (liver, bone and bowel) was seen in 2 cases.

Discussion:

The findings of this study provide valuable insights into the staging and imaging characteristics of cervical cancer based on MRI evaluations. Understanding the distribution of different stages and the imaging features associated with cervical cancer is crucial for accurate diagnosis, treatment planning, and prognostic assessment. In our study, the majority of patients presented with advanced stages of cervical cancer, with stage IV being the most prevalent. This finding is concerning as advanced-stage disease is associated with poorer prognosis and limited treatment options. The high percentage of patients in stage IVA (57.5%) emphasizes the need for early detection and improved screening programs to identify cervical cancer at an earlier, more manageable stage. The limited number of patients in stages I and III highlights the challenges in detecting cervical cancer at these earlier stages.

The signal intensity characteristics on MRI sequences provide additional insights into the imaging features of cervical cancer. The majority of lesions were found to be T1 hypointense and T2 hyperintense, which is consistent with previous studies. These signal intensity patterns can be attributed to the high cellularity and

water content of cervical tumors. The heterogeneity observed in a subset of lesions suggests variations in the tumor microenvironment, such as areas of necrosis, hemorrhage, or fibrosis.

Regarding specific MRI findings, post-contrast enhancement was observed in the majority of cases (90%), indicating the presence of an enhancing tumor mass. This enhancement is essential for distinguishing the tumor from surrounding normal tissues and aids in accurate delineation of tumor boundaries. Uterine invasion was a common finding (77.5%), highlighting the need for assessing the extent of tumor involvement within the uterine wall, which is critical for treatment decisions and surgical planning.

Vaginal invasion, although less frequent (32.5%), remains an important consideration as it affects treatment approaches, including the choice between radical hysterectomy or chemoradiation. Tumor extension to adjacent pelvic organs was seen in a substantial proportion of cases (80%), emphasizing the need for a comprehensive evaluation of tumor extent to guide surgical decision-making and determine resectability.

Lymph node involvement plays a crucial role in staging and prognosis. In our study, pelvic lymph node involvement was observed in 57.5% of cases, suggesting the need for thorough evaluation and potential lymph node dissection in these patients. However, para-aortic lymph node involvement was relatively rare (5%), indicating a lower propensity for distant spread. Detection of distant metastasis was infrequent (5%), although it is crucial to identify potential sites of spread for appropriate management.⁹

It is important to note that the findings of this study should be interpreted within the context of its limitations. The study had a relatively small sample size, and the results may not be generalizable to the broader population. Additionally, the study was conducted at a single center, which could introduce institutional bias. Future studies with larger sample sizes and multi-center collaborations are needed to validate these findings and enhance their applicability.

Conclusion:

In conclusion, MRI plays a crucial role in the staging and evaluation of cervical cancer. The findings from this study highlight the predominance of advanced-stage disease and the importance of early detection and improved screening efforts. The signal intensity characteristics and specific MRI findings provide valuable information for treatment planning and prognostic assessment. By optimizing the utilization of MRI in the evaluation of cervical cancer, clinicians can make more informed decisions, improve patient outcomes, and contribute to the overall management of this significant health burden.

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