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Original Research Article

Correlation of magnetic resonance imaging findings with clinical staging in carcinoma of the cervix

Sultana Parvin[1]*, Mohammad Ali Kabir[2], Tasnova Zerin Iqbal[3], Ayesha Perveen[4]

[1]Department of Radiology and Imaging, Combined Military Hospital, Sylhet, Bangladesh
[2]Department of Radiology and Imaging, Bangladesh Medical University, Dhaka, Bangladesh
[3]Department of Radiology and Imaging, Ever Care Hospital, Dhaka, Bangladesh
[4]Department of Radiology and Imaging, Ever Care Hospital, Chattogram, Bangladesh

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***Correspondence:**
Dr. Sultana Parvin,
E-mail: sultanaparvin384@gmail.com

ABSTRACT

Background: Cervical carcinoma remains a significant health burden in developing countries, with accurate staging being critical for optimal management. Clinical International Federation of Gynecology and Obstetrics (FIGO) staging has limitations in assessing tumor extent and nodal involvement, whereas magnetic resonance imaging (MRI) offers improved visualization of local and regional disease. This study aimed to evaluate the correlation of MRI findings with clinical staging and assess its diagnostic accuracy in cervical carcinoma.
Methods: This hospital-based retrospective observational study was conducted in the Department of Radiology and Imaging, Combined Military Hospital (CMH), Dhaka, from October 2024 to September 2025. A total of 100 consecutive patients with histologically confirmed cervical carcinoma attending the Gynecology Oncology Department were included. Demographic, clinical, and MRI data were collected using a structured case record form.
Results: The majority of patients were aged 40-49 years (32%), married (85%), and postmenopausal (63%). Clinical FIGO staging showed stage IIIB (28%) and IIB (27%) as most frequent. MRI-based staging identified stage IIIB (31%) and IIB (25%) as most common. Concordance between clinical and MRI staging was 68%, with MRI assigning a higher stage in 65.6% of discordant cases. MRI demonstrated high diagnostic accuracy: parametrial involvement (sensitivity 91%, specificity 85%), pelvic sidewall invasion (94%, 96%), bladder/rectal involvement (87%, 98%), and tumor size >4 cm (92%, 90%).
Conclusions: MRI shows high concordance with clinical staging and superior detection of advanced disease, supporting its routine use for preoperative staging and treatment planning in cervical carcinoma.

Keywords: Cervical carcinoma, MRI, FIGO staging, Diagnostic accuracy, Parametrial involvement

INTRODUCTION

Cervical cancer is the fourth most common cancer among women worldwide, with an estimated 660,000 new cases reported in 2022. In the same year, approximately 350,000 women died from the disease, with nearly 94% of these deaths occurring in low- and middle-income countries.[1] Cervical carcinoma continues to be a major health burden, especially in developing countries where it remains a leading cause of cancer-related death among women.[2] The disease is typically slow-growing but may invade the vagina, paracervical tissues, bladder, rectum, and lymph nodes.[3]

FIGO staging system, based mainly on tumor size and local extent, remains standard for clinical staging.[1] While FIGO staging widely used, it has significant limitations, including underestimation of disease extent and omission of important prognostic factors such as tumor volume, vascularization, stromal invasion, and nodal status.[4,5]

Clinical examination alone is inadequate for assessing parametrial infiltration, pelvic sidewall involvement, and accurate tumor size. Although detection of enlarged pelvic nodes is equated with stage III disease, and para-aortic or inguinal nodes with stage IV, this approach lacks precision.[6,7] MRI has emerged as the most accurate imaging modality, capable of defining tumor size and morphology, detecting parametrial and pelvic sidewall invasion, and assessing nodal involvement, while also reducing the need for invasive procedures.[8,9] Despite its advantages, MRI is still underutilized, with a recent survey reporting that up to 30% of centers do not routinely use it for staging.[10] Staging is usually performed by inspection and rectovaginal palpation, with additional procedures such as cystoscopy or proctoscopy when indicated. Although CT and MRI are recommended by FIGO, their use is not mandatory; however, CT has limited value compared to MRI.[11,12]

The role of MRI in assessing parametrial involvement and lymph node metastases is well established. However, accurate evaluation of pelvic sidewall invasion in advanced disease, particularly in stage IIIB carcinoma, remains less well studied. Given the prognostic differences between stage IIB and IIIB disease, further evidence is needed to validate the role of MRI in advanced cervical cancer.[13-15]

In Bangladesh, cervical cancer remains one of the most prevalent gynecological malignancies, with many cases diagnosed at an advanced stage due to limited screening and delayed presentation.[16] Accurate preoperative staging is crucial for determining appropriate treatment strategies, including the feasibility of surgery or the need for chemoradiation.[7] As MRI offers superior soft-tissue contrast and multiplanar imaging capability, it can play a vital role in improving diagnostic accuracy and guiding management decisions in resource-limited settings. Correlating MRI findings with clinical staging can provide valuable insights into its reliability in the local context.[4,12]

Therefore, the present study aimed to correlate MRI findings with clinical staging in carcinoma of the cervix and to evaluate its role in guiding therapeutic decisions.

METHODS

This hospital-based retrospective observational study was conducted in the Department of Radiology and Imaging, Combined Military Hospital (CMH), Dhaka Cantonment, over a 12-month period from October 1, 2024, to September 30, 2025. The study included consecutive patients diagnosed with carcinoma of the cervix who attended the Gynecology Oncology Department of CMH, Dhaka, during the study period. Eligible patients were selected using purposive consecutive sampling after obtaining informed written consent.

The main outcome variables studied were the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of MRI for detecting parametrial invasion, pelvic sidewall invasion, bladder or rectal involvement and nodal metastasis. The correlation between tumor size estimated by MRI and clinical assessment was also evaluated. Covariates included age, parity, menopausal status, duration of presenting symptoms and histologic subtype or grade (when available).

Women aged 18 years or older with histopathologically confirmed cervical carcinoma were included if they had undergone FIGO clinical staging performed by a gynecologic oncologist before MRI or within 14 days of MRI without any intervening treatment and were able and willing to provide written informed consent. Patients were excluded if they had received prior treatment for cervical cancer such as surgery, radiotherapy, chemotherapy, or chemoradiation; if they were pregnant (first trimester or any stage where MRI or contrast was contraindicated per local policy); or if they had contraindications to MRI such as non-MRI–compatible implants or severe claustrophobia. Poor-quality MR images due to motion or artifacts that precluded proper assessment were also excluded.

According to the FIGO classification, carcinoma of the cervix is staged based on the extent of tumor spread. Stage I disease is strictly confined to the cervix, with stage IA representing microscopic invasive carcinoma and Stage IB including clinically visible lesions or microscopic lesions ≥5 mm in depth. Stage II indicates tumor extension beyond the uterus but not to the pelvic wall or lower third of the vagina; stage IIA involves the upper two-thirds of the vagina without parametrial invasion, while stage IIB includes parametrial invasion without reaching the pelvic wall. Stage III represents further local spread, where Stage IIIA involves the lower third of the vagina without pelvic wall extension, and stage IIIB denotes tumor extension to the pelvic wall and/or causing hydronephrosis or a non-functioning kidney. Finally, stage IV indicates advanced disease, with stage IVA showing local invasion into the bladder or rectal mucosa, and Stage IVB representing distant metastasis beyond the true pelvis.

Cervical carcinoma was defined as a malignant tumor arising from the epithelial lining of the uterine cervix, confirmed by histopathological examination. Clinical staging (FIGO staging) referred to the determination of disease extent through physical and rectovaginal examination with or without adjunct procedures. MRI was defined as a non-invasive imaging modality using magnetic fields and radiofrequency waves to evaluate tumor size, parametrial invasion, pelvic sidewall involvement and lymph node metastasis.

Data were collected using a pre-tested structured case record form that included patient demographics, clinical history, MRI findings and clinical FIGO stage. Pelvic

MRI was performed using a high-resolution 1.5 or 3 Tesla scanner following standardized imaging protocols. MRI findings were documented and correlated with the corresponding clinical staging to assess diagnostic concordance. Data were entered into a secured database and analyzed using statistical package for the social sciences (SPSS) version 20.0. Descriptive statistics were expressed as frequency and percentage for categorical variables and as mean±standard deviation for continuous variables. Sensitivity, specificity, PPV and NPV of MRI were calculated for key staging parameters and the concordance between MRI and clinical staging was assessed. Quality assurance was maintained throughout the data collection, entry and analysis process. Ethical approval for the study was obtained from the Ethical Review Board of Combined Military Hospital, Dhaka, prior to data collection.

RESULTS

Figure 1 shows the distribution of patients by age shows that the majority of cervical carcinoma cases were observed in the 40-49-year age group (32%), followed by 50-59 years (28%) and ≥60 years (22%). The lowest proportion was found among women aged 30-39 years (18%).

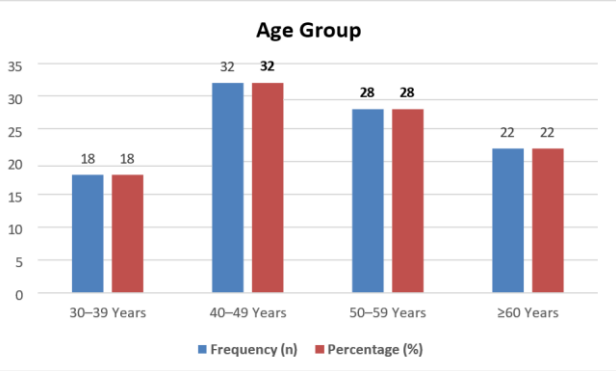

Figure 1: Distribution of patients by age, (n=100).

Figure 2 presents the distribution of patients by marital and menopausal status. Most participants were married (85%), while 4% were unmarried and 11% were widowed or divorced. Regarding menopausal status, 63% were postmenopausal and 37% were premenopausal.

Table 1 summarizes the parity and clinical history of the study participants. Nearly half of the women (47%) had 3-4 children, while 32% had ≥5 and 21% had 0-2. The most common presenting complaint was abnormal vaginal bleeding (62%), followed by vaginal discharge (54%), pelvic pain (36%) and post-coital bleeding (18%). Most patients (44%) reported symptom duration of 4-6 months. A large majority (80%) had never undergone cervical screening, while 12% had normal and 8% had abnormal Pap smear results. Only 3% had a history of previous gynecologic malignancy and 24% had comorbid conditions.

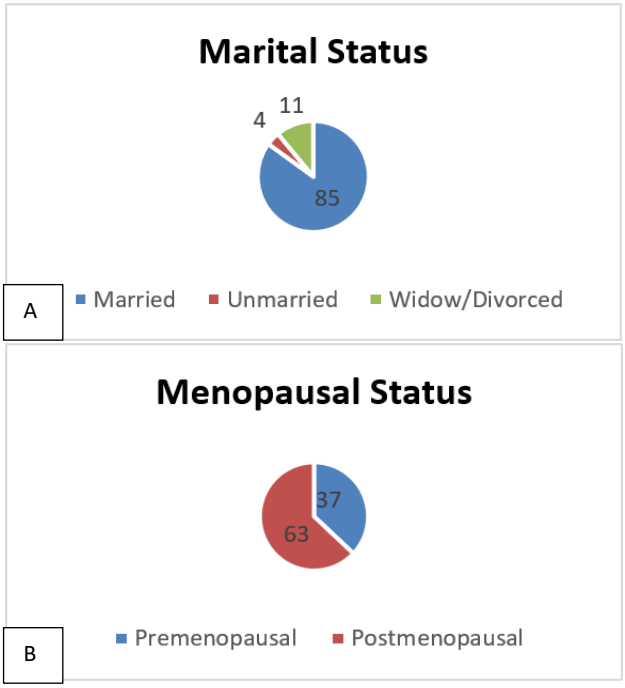

Figure 2 (A and B): Distribution of patients by marital and menopausal status, (n=100).

Table 2 presents the clinical examination findings based on FIGO staging components. Cervical lesions measuring 2-4 cm and >4 cm were equally common (42% each), while 16% had lesions <2 cm. Vaginal involvement was absent in 55% of patients, limited to the upper two-thirds in 28% and extended to the lower one-third in 17%. Parametrial involvement was absent in 40% of cases, unilateral in 33% and bilateral in 27%. Clinically, bladder or rectal involvement was detected in 15% of patients, whereas the 85% showed no evidence of the such invasion.

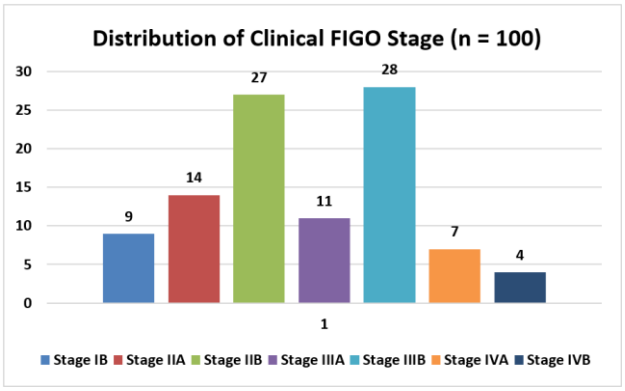

Figure 3: Distribution of clinical FIGO stage, (n=100).

Figure 3 shows the distribution of patients according to clinical FIGO staging. The majority were diagnosed at

stage IIIB (28%) and stage IIB (27%), indicating a predominance of locally advanced disease. Early stages such as IB and IIA accounted for 9% and 14% of cases, respectively. Advanced stages, including stage IVA and IVB, were observed in 7% and 4% of patients, respectively, suggesting delayed presentation and diagnosis in a significant portion of the study population.

Table 3 illustrates the MRI findings of patients with carcinoma of the cervix. Most tumors measured 2-4 cm (43%), followed by >4 cm (45%) and <2 cm (12%). The majority of lesions appeared hyperintense (67%) on T2-weighted image, while 27% were isointense and 6% hypointense. Vaginal involvement was observed in half of the cases, most commonly limited to the upper two-thirds (31%). Parametrial involvement was absent in 37%, unilateral in 34% and bilateral in 29%. Pelvic sidewall invasion was noted in 21% of patients, while bladder or rectal wall invasion was seen in 17%.

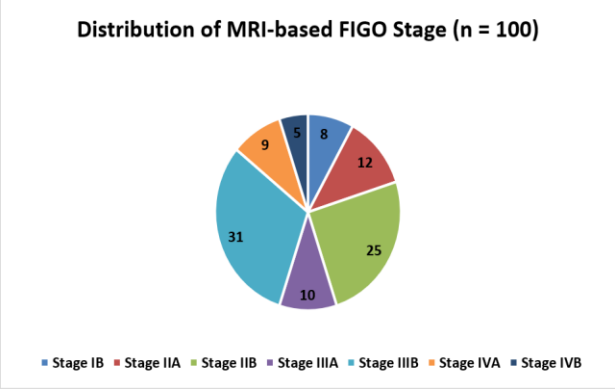

Figure 4: Distribution of MRI-based FIGO stage, (n=100).

Figure 4 presents the distribution of patients according to MRI-based FIGO staging. The majority of cases were classified as stage IIIB (31%) and stage IIB (25%), reflecting a predominance of locally advanced disease. Early stages, including IB and IIA, accounted for 8% and 12% of patients, respectively.

Advanced stages IVA and IVB were observed in 9% and 5% of patients, respectively, suggesting that MRI identified slightly more cases in higher stages compared to clinical assessment.

Table 4 shows the correlation between clinical and MRI-based FIGO staging. Overall, 68% of patients had concordant staging, while 32% showed discordance. Among the discordant cases, MRI assigned a higher stage than clinical assessment in 65.6% of patients, whereas it reported a lower stage in 34.4%, indicating that MRI frequently detected more advanced disease than clinical examination alone.

Table 5 shows the diagnostic accuracy of MRI compared to clinical assessment in 100 patients with cervical carcinoma. For parametrial involvement, 60 patients were clinically positive and 40 clinically negative, while MRI detected 63 positive and 37 negative cases, yielding a sensitivity of 91%, specificity of 85%, PPV of 87% and NPV of 90%. Pelvic sidewall invasion was clinically positive in 18 patients and negative in 82; with sensitivity 94%, specificity 96%, PPV 89% and NPV 98%.

Bladder or rectal involvement was clinically positive in 15 patients and negative in 85, while MRI detected 17 positive and 83 negative cases, with sensitivity 87%, specificity 98%, PPV 93% and NPV 96%. Finally, for tumor size >4 cm, 42 patients were clinically positive and 58 negative, with MRI showing 45 positive and 55 negative, resulting in sensitivity 92%, specificity 90%, PPV 90% and NPV 92%.

Table 1: Distribution of parity and clinical history, (n=100).

Variables	Category	N	Percentages (%)
Parity	0-2	21	21
	3-4	47	47
	≥5	32	32
Presenting complaints	Abnormal vaginal bleeding	62	62
	Post-coital bleeding	18	18
	Vaginal discharge	54	54
	Pelvic pain	36	36
	Others (backache, fatigue, etc.)	8	8
Duration of symptoms	≤3 months	26	26
	4-6 months	44	44
	>6 months	30	30
Past cervical screening (Pap smear)	Yes, normal	12	12
	Yes, abnormal	8	8
	No screening	80	80
Previous gynecologic malignancy	Yes	3	3
	No	97	97
Comorbidities	Present	24	24
	Absent	76	76

Table 2: Clinical examination findings (FIGO staging components), (n=100).

Variables	Category	N	Percentages (%)
Cervical lesion size (on speculum)	<2 cm	16	16
	2–4 cm	42	42
	>4 cm	42	42
Vaginal involvement	Absent	55	55
	Upper 2/3	28	28
	Lower 1/3	17	17
Parametrial involvement	Absent	40	40
	Unilateral	33	33
	Bilateral	27	27
Bladder/rectal involvement (clinical)	Yes	15	15
	No	85	85
Pelvic sidewall invasion	Yes	18	18
	No	82	82

Table 3: MRI findings, (n=100).

Variables	Category	N	Percentages (%)
Tumor size (maximum diameter)	<2 cm	12	12
	2-4 cm	43	43
	>4 cm	45	45
Tumor signal intensity on T2- weighted image	Hypointense	6	6
	Isointense	27	27
	Hyperintense	67	67
Vaginal involvement	Absent	50	50
	Upper 2/3	31	31
	Lower 1/3	19	19
Parametrial involvement	Absent	37	37
	Unilateral	34	34
	Bilateral	29	29
Pelvic sidewall invasion	Yes	21	21
	No	79	79
Bladder/rectal wall involvement (MRI)	Yes	17	17
	No	83	83
Pelvic lymphadenopathy	Absent	62	62
	Present (short axis >10 mm)	38	38

Table 4: Correlation between clinical and MRI staging, (n=100).

Correlation parameters	N	Percentages (%)
Concordant (same clinical and MRI stage)	68	68
Discordant (different stages)	32	32
Total	100	100
Among discordant cases, (n=32)		
Direction of difference		
MRI stage higher than clinical stage	21	65.6
MRI stage lower than clinical stage	11	34.4

Table 5: Diagnostic accuracy of MRI compared to clinical assessment in cervical carcinoma, (n=100).

Parameter	Clinical positive	Clinical negative	MRI positive	MRI negative	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Parametrial involvement	60	40	63	37	91	85	87	90
Pelvic sidewall invasion	18	82	21	79	94	96	89	98
Bladder/rectal involvement	15	85	17	83	87	98	93	96
Tumor size (>4 cm)	42	58	45	55	92	90	90	92

DISCUSSION

This study evaluated the correlation between clinical staging and MRI findings in 100 Bangladeshi patients with cervical carcinoma and assessed the diagnostic accuracy of MRI for parametrial, pelvic sidewall, bladder/rectal involvement and tumor size. The patient profile, with a majority aged 40-49 years, married (85%) and postmenopausal (63%), aligns with prior regional data showing cervical carcinoma predominantly affects middle-aged, multiparous women with limited screening exposure.[17] The high proportion of patients (80%) without prior cervical screening reflects ongoing gaps in preventive services in low- and middle-income countries.

Clinically, most tumors measured 2-4 cm and >4 cm (42% each) and stage IIIB (28%) and IIB (27%) were most frequent, which is consistent with Balcacer et al and Otero-García et al who reported advanced-stage presentation in populations with limited screening.[18,19] Vaginal involvement was absent in more than half of the patients, whereas parametrial involvement was unilateral or bilateral in 33% and 27%, respectively. Bladder or rectal involvement was relatively uncommon (15%), supporting Zhu et al and Luo et al who emphasized that clinical examination alone can underestimate deep tissue invasion and tumor spread.[20,21]

MRI findings provided more precise evaluation of tumor size and local extension. Tumors measuring 2-4 cm and >4 cm accounted for 43% and 45% of cases, respectively, with 67% demonstrating hyperintense signal intensity. These values closely correspond with findings reported by Karunya et al and Park et al who documented MRI sensitivity for parametrial and nodal involvement between 85-95%, demonstrating that MRI provides superior anatomical detail and can detect lesions not appreciable on clinical examination.[22,23]

The concordance between clinical and MRI staging was 68%, with discordance in 32% of patients; MRI upstaged 65.6% of cases and downstaged 34.4%. This trend reflects the well-recognized tendency of MRI to detect more advanced disease than clinical assessment alone.[24,25] Re et al and Shih et al emphasized that MRI upstaging frequently identifies parametrial extension and lymph node metastasis that may alter treatment planning, particularly in settings where clinical palpation can miss subtle spread.[26,27]

The diagnostic accuracy of MRI in our study was high. For parametrial involvement, sensitivity, specificity, PPV and NPV were 91%, 85%, 87% and 90%, respectively. Pelvic sidewall invasion showed sensitivity 94% and specificity 96%; bladder/rectal involvement had sensitivity 87% and specificity 98%; and tumor size >4 cm yielded sensitivity 92% and specificity 90%. These results align with prior studies reporting high accuracy of MRI in evaluating local tumor extent and nodal status.[28-30] MRI demonstrated excellent negative predictive values, particularly for pelvic sidewall invasion (98%) and bladder/rectal involvement (96%), highlighting its reliability in ruling out extensive disease, which is crucial for preoperative planning and radiotherapy decision-making.

Overall, our findings reinforce the role of MRI as a complementary tool to clinical staging in cervical carcinoma. MRI not only improves the detection of parametrial, sidewall and nodal involvement but also provides more accurate tumor size estimation, thereby enhancing treatment planning and prognostication. In the context of Bangladeshi patients, where late presentation and limited screening are common, MRI can help identify occult disease and guide individualized management strategies.[18]

Limitations

This study was conducted at a single center with a relatively small sample size, which may limit the generalizability of the findings. Histopathological confirmation of MRI findings was not performed in all cases, potentially affecting diagnostic accuracy assessment. Inter-observer variation in MRI interpretation was also not evaluated. Future multicenter studies with larger cohorts and histopathologic correlation are recommended to validate these results. Incorporating advanced MRI techniques and ensuring wider access to imaging facilities could further improve staging accuracy and management outcomes in cervical carcinoma.

CONCLUSION

In conclusion, MRI demonstrates high diagnostic accuracy and correlates well with clinical staging while often detecting additional disease not appreciated clinically. Integration of MRI into routine pre-treatment evaluation can improve staging precision, treatment selection and outcomes for cervical cancer patients, particularly in resource-limited settings.

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

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