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Original Research Article

Comparative Evaluation of the Treatment Planning According to the Figo Staging and MRI Staging Classification in Carcinoma Cervix

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Abstract

Background: Cervical cancer is a major public health problem for women. Accurate staging may lead to proper management of cervical cancer.

Methodology: We retrospectively reviewed all patients from 1st June 2015 to 31st March 2017 with cervical cancer who underwent pre-treatment MRI and analyzed the correlation between the FIGO clinical staging and MRI staging.

Results: Correlation of overall clinical and MRI staging by percent agreement is moderate (73.9%), but the kappa coefficient showed a slight correlation. The correlation of clinical and MRI findings in the vaginal invasion, pelvic sidewall invasion, adjacent pelvic organ invasion, and spreading to distant organ also showed moderate-to-strong correlation by percent agreement (ranging from 67.6 to 91.9%) but slight correlation between clinical and MRI examinations by kappa or weighted kappa coefficient ($K = 0.000–0.128^{w}$).

Conclusion: In patients with cervical cancer, pretreatment MRI provides higher spatial soft tissue resolution which can define pelvic tumor extent, including a more accurate assessment of tumor size (due to multiplanar evaluation), parametrial invasion, pelvic sidewall invasion, and adjacent pelvic organ invasion. This could potentially lead to a reduction in staging morbidity by invasive investigation such as cystoscopy and proctoscopy.

Keywords: cervical cancer, FIGO staging, MRI staging

Introduction

According to the GLOBOCAN publication in 2020, cervical cancer is ranked as the fifth most common female cancer (16.4 per 100,000). The treatment of choice for

cervical cancer is divided into two main strategies depending on the clinical staging based on the International Federation of Gynecology and Obstetrics (FIGO) classification system [1, 2].

1. Radical surgery (including trachelectomy or radical hysterectomy) for early-stage disease (FIGO stage IA, IB1, and IIA)
2. Primary radiotherapy with concurrent chemotherapy for patients with bulky tumor (FIGO stage IB2/IIA2) or locally advanced disease (FIGO stage IIB or greater)

The FIGO staging is determined by pelvic examination, bladder cystoscopy, proctoscopy, and colposcopy in combination with imaging (including chest and skeletal radiography, intravenous pyelography, and barium enema). However, staging according to the old system (i.e., FIGO cervical cancer staging systems from 1999, 2009, and 2014) was inaccurate, with 20–40% of stages IB–IIIB cancer being under-staged and up to 64% of stage IIIB cancer being over-staged [3]. Clinical assessment based on the old FIGO system also has limitations to evaluate the actual tumor size, adjacent organ involvement, and lymphadenopathy. Magnetic resonance imaging (MRI) is a non-invasive investigation that can provide a more accurate estimation of tumor size, parametrial and pelvic sidewall invasion, as well as pelvic and abdominal lymphadenopathy which are all important deterministic for the accurate staging of cervical cancer for prognosis and treatment planning. Furthermore, the use of MRI can avoid using unnecessary invasive investigations such as cystoscopy, proctoscopy, and intravenous pyelography [4]. This study is, therefore, aimed to compare and analyze the correlation between clinical FIGO system and MRI findings and staging of cervical cancer.

Methodology

This retrospective study included 35 patients with histologically confirmed cervical cancer in the gynecology tumor clinic. The ages of patients ranged from 33 to 74 years old, and all of them underwent assessment of clinical staging according to the FIGO guideline and pretreatment MRI for lower abdomen in our institute from 1st June 2015 to 31st March 2017 who attended This study was conducted at the Department of Radio-diagnosis and Imaging in collaboration with the Departments of Oncology and Obstetrics & Gyenecology at tertiary care center and was approved by the Ethics Committee for Human Research based on the Declaration of Helsinki and the ICH Good Clinical Practice Guidelines.

Inclusion criteria

All patients with histological confirmation of cervical cancer in the gynecology tumor clinic, from January 2009 to December 2018 and underwent pretreatment MRI in our institute.

Exclusion criteria

1. Patient with cervical cancer without pretreatment MRI evaluation.

2. The patient underwent previous cervical cancer treatment such as previous surgery (except for tissue diagnosis), previous chemotherapy, or radiation.

Clinical staging

The clinical FIGO staging information (based on both 2009 and 2018 versions of FIGO staging) of the cervical cancer patients are retrospectively retrieved from the medical records in the Gynecology Tumor Clinic by 1 oncology gynecologist and 1 radiation oncologist who has more than 5 years of experience. The patients with clinical FIGO staging based on 2009 FIGO were restaged according to 2018 FIGO to standardize the clinical staging. We recorded general information of the

patients such as age at diagnosis of cervical cancer, underlying diseases, and histological type. Clinical staging assessments followed the 2018 FIGO guideline with diagnostic biopsy; pelvic examination; chest radiography; proctoscopy; bladder cystoscopy; intravenous pyelography; or kidney, ureter, and bladder ultrasound. The records include tumor size, vaginal wall invasion, parametrial invasion, pelvic sidewall invasion, hydronephrosis or non-functioning kidney, adjacent organ involvement (bladder or rectum invasion), and distant organ metastasis.

Pre-treatment MRI staging

We retrospectively performed data collection of the cervical cancer patients with pretreatment MRI (from January 2009 to December 2018). The MRI examination records were read in consensus by two radiologists with more than 5 years of experience in female pelvic imaging. The radiologists were aware of the biopsy-proven diagnosis of cervical cancer but were blinded to the patient's identity, the results of physical examination, and clinical staging. The following findings were recorded by radiologists [4, 5].

- Tumor size (in the longest dimension)
- Vaginal wall invasion (disruption of low-signal intensity vaginal wall) as shown in Fig. 1
- Parametrial invasion (disruption of the low-intensity cervical stromal rim, nodularity of parametrial and/or tumor extending to parametrium) as shown in Fig. 2
- Pelvic sidewall invasion (extension of tumor within 2 mm of pelvic sidewall, or involvement of internal obturator, piriformis or levator ani muscles with or without dilated ureter) as shown in Fig. 3
- Hydroureter and hydronephrosis

All newly diagnosed cases of carcinoma cervix received a week of antibiotic therapy following which thorough clinical examination was done. Chest X-ray, cystoscopy, proctoscopy was also done and the clinical stage was assigned based on the FIGO system.

Following which the patients were referred to the Department of Radio-Diagnosis and Imaging for MRI of the abdomen and pelvis. MRI was done on a 1.5T GE HD XT 16 channel volume 1.5 T MRI scanner.

Patient Preparation & Position

Patients are instructed to fast for 4–6 hours before the MRI examination to limit artifact due to small-bowel peristalsis. An antiperistaltic agent (hyoscine or glucagons) may be administered to the patient before imaging as an alternative to fasting. Ideally, the patient is asked to empty the bladder before going on the MR scanner. A full bladder may degrade T2-weighted images because of ghosting and motion artifacts. Patients are imaged in the supine position using a pelvic surface array multichannel coil.

Statistical analysis

The correlation between clinical and MRI stagings was demonstrated using the Kappa coefficient and weighted Kappa with percent agreement.

Results

Table no 1 shows that maximum no. of cases in our study were squamous cell type (68.5%), followed by adenocarcinoma (25.7%). Two cases of adenosqamous variety were also noted.

Table 1: Histopathological distribution of the cases

Histopathology	No. Of patients	Percentage of patients
SQUAMOUS CELL CARCINOMA	24	68.5
ADENOCARCINOMA	9	25.7
ADENOSQUAMOUS CARCINOMA	2	5.7
TOTAL	**35**	**100**

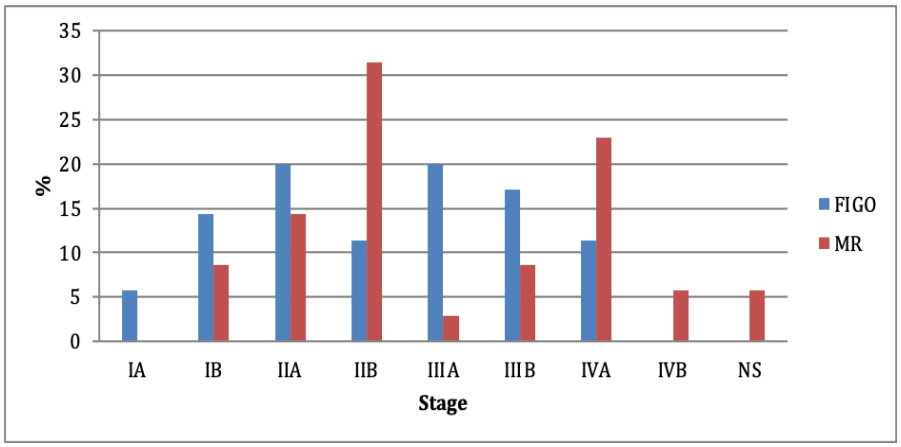

Figure 1: Distribution of stages according to the FIGO and MR staging evaluation

The Graph 1 represents a comparative graph between the no. of cases in our study based on staging by clinical and MRI evaluation. According to clinical evaluation maximum no. of cases belong to stage IIA and IIIA i.e. 7 in no. and each forming 20% of the cases, followed by stage IIIB and IB having 6 (17.1%) and 5 (14.3%) cases respectively. Stage IIB and IVA have 2 (5.7%) cases each. None of the cases belong to stage IVB. According to staging done by MRI evaluation maximum no. of cases belong to stage IIB i.e. 11 forming 31% of total cases. Followed by 8 cases (22.9%) of stage IVA. There are 5 (14.3%) cases of stage IIA. Both stages IB and IIIB have 3 cases (8.6%) each. 2 cases belong to stage IV B. Whereas 2 cases appeared normal on MRI evaluation.

Table 2: Comparison of stage classifications of cases between FIGO and MR

FIGO stage	MR stage								Total	p value
	IB	IIA	IIB	IIIA	IIIB	IVA	IVB	NS		
IA								2	2	p < 0.01
IB	3	2							5	
IIA		2	5						7	
IIB		1	2		1				4	
IIIA				1		4	2		7	
IIIB			4		2				6	
IVA						4			4	
Total	**3**	**5**	**11**	**1**	**3**	**8**	**2**	**2**	**35**	

Table 2 compares the staging classifications between FIGO and MR evaluation. The null hypothesis was there is no significant difference between MR and clinical staging outcomes. However the p value is <0.01. Thus the null hypothesis is rejected and

significant difference between clinical and MRI staging outcomes is present. Compete match (100%) was only observed in the stage IIIA classification. The FIGO and the MR methods have classified the cases differently that has also been approved the calculated p value ($p<0.01$) between the groups.

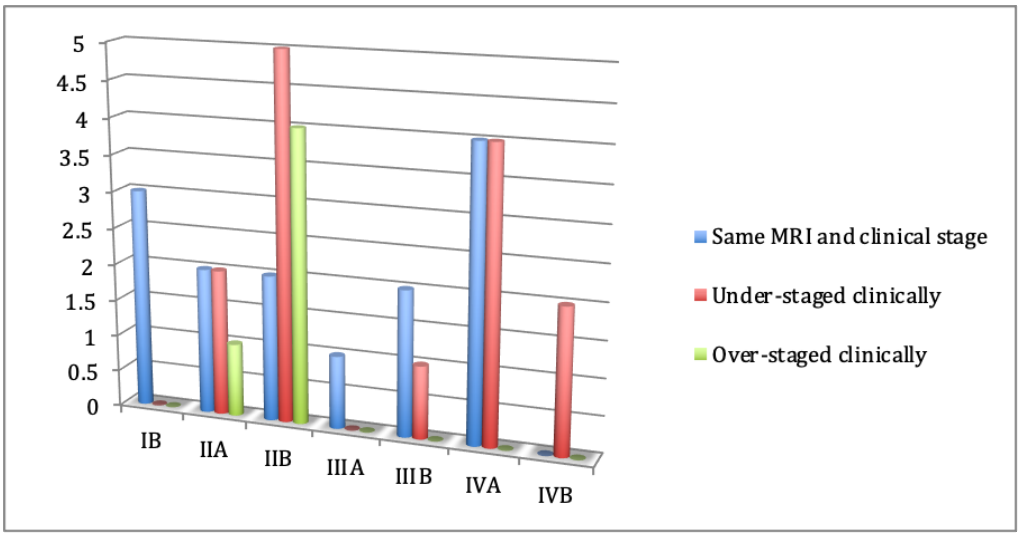

Figure 2: Cases correctly staged, over staged and under staged clinically when compared to MRI.

The above graph 2 shows stage wise distribution of cases that had same stage on clinical evaluation and on MRI evaluation and those which were over or under staged clinically in comparison with MRI. The graph does not include 2 cases that were not picked up on MRI, however were diagnosed as stage IA on clinical evaluation. There were 3 cases of stage IB on MRI staging and all had same stage on clinical staging. 2 out for 5 cases of stage IIa were correctly diagnosed clinically whereas cases over and under diagnosed were 1 and 2 in number respectively. There were 11 cases diagnosed as IIB on MRI out of which 2 were of the same stage on clinical evaluation as well. 4 and 5 cases were over and under diagnosed respectively on clinical staging. Single case was staged as IIIA on both MRI and clinical evaluation both. 2 out of 3 cases of stage IIIB were correctly diagnosed clinically when compared to MRI staging while 1 was under staged clinically. 4cases each were correctly and under diagnosed clinically out of 8 stage IVA cases according to MR evaluation. Both the cases of stage IVB on MRI evaluation were under diagnosed clinically. Histopathological staging was done for the surgically treated cases. There were 11 surgically treated cases belonging to early stages i.e. from stage IA upto stage IIA. 2 cases of stage IIB were also treated by surgery. Surgical staging wherever present has been considered as gold standard. The patients were treated according to the stage of disease on MRI evaluation. However following is the table showing treatment planned for the patient according to the clinical stage and MRI stage.

Table 3: Comparison of the treatment planning according to the FIGO staging and MRI staging classification.

Treatment-FIGO	Treatment- MR						Total		p Value
	Wertheim's Hysterectomy with pelvic Lymph Adenectomy		Radical Hysterectomy with pelvic Lymph Adenectomy		Primary Chemo-Radiation				
	n	%	n	%	N	%	N	%	
Wertheim's Hysterectomy with pelvic Lymph Adenectomy	2	100	2	50	0	0	4	12.1	p<0.001
Radical Hysterectomy with pelvic Lymph Adenectomy	0	0	1	25	5	18.5	6	18.2	
Primary Chemo-Radiation	0	0	1	25	22	81.5	23	69.7	
Total	**2**	**100**	**4**	**100**	**27**	**100**	**33**	**100**	

The above table 3 compares the treatment assigned according to the FIGO and MR staging classifications. The table does not include 2 cases that were reported as normal on MRI. Those according to clinical staging can be treated with simple extra fascial hysterectomy Majority of the cases received the primary chemo-radiation that classified by both the methods (n=22/35 cases, according to MR staging 5 additional cases should also receive chemoradiotherapy. According to MRI staging 4 cases can undergo radical hysterectomy with pelvic lymphadenectomy and 2 cases can undergo Wertheim's hysterectomy. Whereas according to clinical staging 6 cases can undergo radical hysterectomy and in 4 cases Wertheim's can be performed. The treatment modality may differ in 8 cases out of 35 when treated according to clinical or MR staging.

The significant p value ($p<0.01$) indicates that there are significant no. of cases showing difference in treatment planned based on the FIGO and MR classification.

Discussion

Although the correlation between overall clinical and MRI stagings by percent agreement in this study was moderate (73.9%), the kappa coefficient (K = 0.000) showed a slight correlation. This might be due in part to the small sample size in this study. The previous study by Dhoot et al. showed a higher accuracy of 89.3% by MRI staging compared with 61.3% by clinical staging [4]. Another study by Ho et al. (1992) showed the overall accuracy rate of MRI in staging of cervical cancer was 75%, much higher than 55% by clinical staging

[6,7]. Ozsarlak et al. demonstrated that the overall accuracy of cervical cancer staging by clinical examination and by MRI was 47 and 86%, respectively [8]. Shirazi et al. showed 50% correlation between clinical and MRI stagings in stage IIIB patients (which is the main population in our study) [9]. According to the discrepancy between clinical and MRI stagings from previous studies, the slight correlation between clinical staging and MRI staging in cervical cancer in this study suggests the requirement of a large sample size study. Other results such as vaginal invasion, pelvic sidewall invasion, adjacent pelvic organ invasion, and spreading to distant organs also showed moderate-to-strong correlation between clinical and MRI examinations by percent agreement (67.6 to 91.9%), although the correlation between them was only slight by kappa or weighted kappa coefficient (K = 0.000–0.128w). MRI sequences with other imaging modalities were used in the staging and follow the treatment of cervical cancer; i.e. relevant anatomy (including normal MRI appearance of the cervix, parametria, and pelvic ligaments), different stages of cervical cancer with prognostic and therapeutic implications [5-16]. Our results corresponded well with the study by Chung et al. in that all 18 patients with hydronephrosis who were identified by intravenous pyelography were also recognized by MRI or CT.

Conclusion

The International Federation of Gynecology and Obstetrics (FIGO) staging provides the Global epidemiologic and treatment response statistics for carcinoma cervix. However, there are significant fallacies in this staging system, and magnetic resonance imaging, although not included in this system, is now widely accepted as optimal for evaluation of the disease.

MRI is widely recognized as the most reliable imaging technique for the diagnosis, staging and treatment planning for cervical cancer. Protocols for MRI have to be optimized to attain better results and prevent pitfalls. MRI has a key role in the evaluation of cervical cancer, predominantly in identifying tumors without parametrial extension, thus stratifying patients for surgery and radiation therapy. MRI also aids in the identifying the patients for fertility-preserving surgery in early- stage disease. Thus, MRI plays a key role in staging and patient selection for treatment. Magnetic resonance imaging is valuable as an adjunct to clinical assessment of bulky invasive cervical cancer, giving a more comprehensive assessment of morphologic risk factors important in patient prognosis. We recommend incorporation of MRI in pre-operative FIGO staging of cervical cancer.

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