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Radiology

The Efficacy of MRI in Staging of Carcinoma of Uterine Cervix correlation with FIGO Staging

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Abstract **Original Research Article**

Cervical cancer is the most common genital malignancy among the women in the developing countries. The current staging system, that is the FIGO clinical staging system, has got some limitation and inconvenience to the patient. Magnetic Resonance Imaging is accepted as a preferred imaging modality to assess the parametrial invasion, tumor size, lymph node metastasis, evaluation of the main prognostic factors and selection of therapeutic strategy. Hence this study was conducted for comparison of FIGO staging with MRI staging for better staging of Carcinoma Cervix, treatment and follow up. ***Objectives:*** The present study was aimed to find out the sensitivity, specificity, positive and negative predictive value and accuracy of MRI in staging carcinoma cervix by comparing with the FIGO clinical staging system, which was taken as the reference. ***Methods:*** Our study involved 55 patients who were newly diagnosed cases of carcinoma cervix, already staged clinically by the FIGO system and referred to the radiology department for MR imaging of pelvis during the period July 2016 to June 2018. MR imaging of the pelvis and screening of abdomen was done for these patients. Patient was then staged with MRI. Then the predicted stage for each patient with the two methods were compared. The sensitivity, specificity, positive and negative predictive values were obtained. The analysis done by standard Chi square test. ***Results:*** In assessing whether the lesion was confined to cervix or extended beyond cervix accuracy was 94.55%. In assessing the parametrial extension MRI had a accuracy of 92.7%. In assessing the bladder mucosal invasion MRI had an accuracy of 96.3%. In assessing the rectal mucosal invasion MRI had accuracy of 96.3%. Clinical staging and MR staging concurred in 85.45% of cases and differed in 14.45% of cases. ***Conclusion:*** Magnetic resonance imaging in carcinoma cervix has a good sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy in differentiating between different stages of the disease. In addition to the information regarding tumor size and its local extension, MRI also provided details regarding the abdominopelvic lymphadenopathy and metastasis as well as possibility of lung metastasis if pleural effusion or basal lung lesion were present.

Keywords: Carcinoma, Uterine cervix, MRI cervical cancer, FIGO clinical staging.

INTRODUCTION

Cervical cancer is the fourth most common cancer in women worldwide, and the second most common in low-and middle-income countries [1]. It is thus a major cause of morbidity and mortality from cancer. In 2018, there were an estimated 569 847 new cases and 311 365 deaths worldwide annually [1]. More than 85% of these cases occur in developing countries.[1]The treatment of cervical carcinoma is largely dependent on tumor stage. The predominant tool in the staging procedure is the FIGO staging system from 1958, which is based upon clinical examination during anesthesia by an experienced examiner [2]. The clinical stage according to FIGO is not changed because of subsequent imaging findings [3]. A large number of studies, both retrospective and prospective, have been made to assess whether the use of Computed Tomography (CT) and/or Magnetic Resonance Imaging (MRI) in addition to the FIGO classification improves evaluation of the extent of disease and if they can identify morphological risk factors of poor survival. The results have shown over-all staging accuracies ranging between 75% and 90% not taking the study setup and particular risk factors into account [4]. The staging accuracy of the FIGO system has been reported to be 50 – 80% with a tendency to be better in earlier stages than in more advanced stages [5]. In 2003, MRI of the pelvis and abdomen was introduced at our unit as a routine part of the initial work-up for all patients with

cervical carcinoma in addition to the standard FIGO examination in order to replace CT and urography 6].

In this study our main goal was to estimate the efficacy of MRI in Staging of Carcinoma of Uterine Cervix and to evaluate the MRI-FIGO comparison of parametrial, urinary bladder and rectal invasion and to identify age distribution of the patients.

MATERIALS AND METHODS

Population

This study involved 55 objects who were newly diagnosed cases of carcinoma cervix, already staged clinically by the FIGO system and referred to the radiology department of Jalalabad Ragib-Rabeya Medical College, Sylher, Bangladesh, for MR imaging of pelvis during the period July 2016 to June 2018. MR imaging of the pelvis and screening of abdomen was done for these patients. Patient was then staged with MRI.

MRI Protocol

Patients were examined with a 1.5-T MRI (Magnetom Avanto, Siemens Healthcare Ltd.). Patients were instructed to fast for 6 hours before examination to reduce small bowel peristalsis artifacts the study was performed with the patients lying supine with their median sagittal plane perpendicular and coinciding with the midline of the scanner table. Axial T2WI were obtained from the kidney to perineum using 256*256 matrix,32cmfield of view (FOV), 4mm slice thickness,1mminterslice gap and 2 number of excitation (NEX).Post contrast images were obtained in axial, coronal and sagittal planes and were useful to identify bladder and rectal wall invasion, fistulas and in the detection of recurrent tumor. Dynamic images obtained 30 to 60 seconds after gadolinium injection were helpful for the assessment of smaller tumors which were not visible on T2WI as they showed increased early contrast enhancement relative to cervical stroma. For screening the abdomen, fat suppressed T2WI images were obtained in axial plane from the diaphragmatic dome level and in some cases diffusion weighted sequences were also included. Then the MRI evaluation and staging done.

MR image analysis and staging

Tumors generally originate from the squamocolumnar junction, and this is why, exophytic masses are common in younger females where as endocervical masses are common in older females.[7] Tumor tissue has significantly low apparent diffusion coefficient value as compared to non tumor tissue [8]. Stage I tumor is limited to cervix. Stage IA is microscopic disease and is not visible on MRI. A visible tumor clinically stage the patient as IB or higher. Peripheral T2-hypointense stroma is maintained in IB [7]. Stage II is considered when the tumor extends beyond the cervix. Involvement of the upper two-third of the vagina is seen as segmental loss of the normally seen T2-hypointense vaginal wall and is staged as IIA. According to revised FIGO staging, if the tumor size is ≤4 cm, it is stage IIA1 and if it is >4cm, it is stage II A2. In stage II B, the tumor disrupts the normally seen hypointense peripheral stroma onT2W images and extends in the parametrium [7]. Intact T2-hypointense stroma ring has a high negative predictive value for parametrial invasion and is between 94% and 100% [10]. Confident diagnosis of parametrial invasion is made when one sees the spiculated tumor-parametrial interface, soft tissue mass in parametrium, encasement of periuterine vessels, and ureter [11]. MRI sometimes can over stage large tumors due to edema or inflammation caused by tumor compression, which should be kept in mind while planning treatment [11]. Stage III is defined as tumor extension to the lower third of the vagina or lateral pelvic wall with associated hydronephrosis. Involvement of lower third of the vagina without extension to pelvic wall is III A. Rarely one may see the infiltration of posterior bladder wall without extension to the bladder mucosa. Stage III B is considered when the tumor is less than 3 mm from the side wall, causes hydroureter, infiltrates the obturator internus, pyriformis, and levator ani muscles, encases the iliac vessels, and destroys the pelvic bones [9]. Presence of bladder or rectal mucosa involvement or distant metastasis upgrades the tumor to stage IV. In stage IVA, bladder and rectal invasion is suggested by the presence of focal or diffuse disruption of the normally seen T2-low signal intensity wall, irregular or nodular wall, and presence of an intraluminal mass. Bulbous edema sign, which is hyperintense thickening of the bladder mucosa on T2W images, is an indirect sign of invasion and should be evaluated with care for associated tumor nodule [9].

STATISTICAL ANALYSIS

Statistical analysis was performed by using software SPSS, version 23;(SPSS Inc., Chicago, Illinois, USA), with Clinical staging (FIGO) was taken as the reference standard. We considered the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy of MRI.

RESULTS

Among study population most of the cases belongs to 41-45 years age group; 45.45% (Table-1).

In assessing whether the lesion was confined to cervix or extended beyond cervix sensitivity, specificity, PPV, NPV, & accuracy was 66.67%, 100%, 100% 93.88% and 94.55% respectively (Table-2).

In assessing the parametrial extension MRI had a sensitivity, specificity, PPV, NPV, & accuracy of 100%, 71.43%, 91.1%, 100%, 92.73% respectively (Table-3).

In assessing the bladder mucosal invasion MRI had a sensitivity, specificity, PPV, NPV, & accuracy of 100%, 95.74%, 80%, 100%, 96.36% respectively (Table-4).

In assessing the rectal mucosal invasion MRI had a sensitivity, specificity, PPV, NPV, & accuracy of 100%, 96%, 66.6%, 100%, 96.3% respectively (Table-5).

Clinical staging and MR staging concurred in 85.45% of cases and differed in 14.5% of cases.

Table-1: Age distribution of the patients

Age group in years	Number (%)
35-40	9(16.3)
41-45	25(45.45)
46-50	10(18.2)
51-55	11(20)

Table-2: Comparison of MRI and FIGO in determination of Tumor extension

MRI finding	Clinical -FIGO finding		Total
	Confined to cervix	Extend beyond cervix	
Confined to cervix	6	0	6
Extend beyond cervix	3	46	49
Total	9	46	55

Table-3: Comparison of MRI and FIGO in determination of Parametrial invasion

MRI finding	Clinical -FIGO finding		Total
	Parametrial invasion Present	Parametrial invasion Absent	
Parametrial invasion Present	41	4	45
Parametrial invasion Absent	0	10	10
Total	41	14	55

Table-4: Comparison of MRI and FIGO in determination of Urinary Bladder invasion

MRI finding	Clinical -FIGO finding		Total
	Urinary Bladder invasion Present	Urinary Bladder invasion Absent	
Urinary Bladder invasion Present	8	2	10
Urinary Bladder invasion Absent	0	45	45
Total	8	47	55

Table-5: Comparison of MRI and FIGO in determination of Rectal invasion

MRI finding	Clinical -FIGO finding		Total
	Rectal invasion Present	Rectal invasion Absent	
Rectal invasion Present	4	2	6
Rectal Bladder invasion Absent	0	49	49
Total	4	51	55

Table-6: Comparison of MRI and FIGO in overall staging

MRI staging	Clinical -FIGO staging				Total
	Stage I	Stage II	Stage III	Stage IV	
Stage I	6	0	0	0	6
Stage II	2	20	4	0	26
Stage III	0	0	7	0	7
Stage IV	0	2	1	13	16
Total	9	22	12	13	55

DISCUSSION

In the present study staging of carcinoma cervix was done with FIGO staging and MRI staging with biopsy proven cases and primary treatment given with surgery, radiotherapy and chemo radiation. From the results of this study it is evident that MRI is useful for determining accurate staging of carcinoma cervix. Though results showed MRI is useful for determining extent of disease, 85% correlated with FIGO staging which is usually done for primary treatment and follow up.

In the present study the sensitivity, specificity, PPV, NPV and accuracy of MRI in assessing the lesion as whether it was confined to cervix or extended beyond cervix was 66.6%, 100%, 100%, 93.8% and 94.5% respectively, P value was significant (<0.001); our results were comparable with study conducted by Nisha Unni *et al*., [12] who found sensitivity, specificity, PPV, NPV and accuracy of MRI were 60%, 100%, 100% 92.7% and 93% respectively. The accuracy rate of 94.5% in our study our study was comparable with the study of Kraljevic Z *et al*., [13] who got an accuracy rate of 90.9%.

For assessing the parametrial invasion, MRI was shown to have a sensitivity of 100%, specificity of71.4%, PPV of 91.1%, NPV of 100%, and accuracy of 92.7%. P value was significant (<0.001). According to the study of Zhang *et al*., [14] and Nisha Unni *et al*., [12] the negative predictive value of MRI in detecting parametrial invasion were 100% which correlated with our study.

In the present study MRI evaluation to assess bladder invasion showed the following statistical values; Sensitivity 100%, Specificity 95.7%, Positive predictive value 80%, Negative predictive value 100%, and Accuracy 96.3 %. P value was significant (<0.001). Nisha Unni *et al*., [12] found Sensitivity= 100%, Specificity 94%, Positive predictive value 78.6%, Negative predictive value=100%, and Accuracy 95 % in MRI evaluation to assess bladder invasion by carcinoma cervix; which correlated with the present study.

Rectal invasion assessment with MRI in the present study had Sensitivity 100%, Specificity 96.5%, Positive predictive value 66.7%, Negative predictivevalue100%, and Accuracy 96.7 %. P value was significant(<0.001); these results were comparable with the study conducted by Kim WY [15] who found out that MRI sensitivity, specificity, positive and negative predictive value and accuracy of bladder orrectum mucosal invasion were 100%, 96%, 41.2%, 100% and 96.1% respectively. Nisha Unni *et al*., [12] found Sensitivity 100%, Specificity 96.5%, Positive predictive value 66.7%, Negative predictive value 100%, and Accuracy 96.7 % which were comparable with the present study.

Based on the absence of invasion, MRI was safe enough without concern for understaging as MRI is highly sensitive with high negative predictive value in evaluating the bladder and rectal mucosal invasion; therefore skipping cystoscopy or sigmoidoscopy. Giuliano Rigon *et al*., [17] concluded that MRI use is encouraged for cervical cancer staging. There is good correlation between histological and MRI tumor bulk. MRI has been proposed as a substitute for invasive cystoscopy and proctoscopy in initial screening of cervical cancer.[17] A Jena, et al in their retrospective study was to determine the correlation between MRI measured tumor volume and parametrial invasion on histology in the evaluation of carcinoma cervix showing full thickness stromal invasion (FTSI) of 159 surgical cases of carcinoma cervix with original MRI images. They concluded that MRI measured tumor volume is associated with low accuracy in the evaluation of parametrial invasion in carcinoma cervix, may not help as an, additional diagnostic criterion to predict parametrial invasion pre operatively [18].

When the patient was assessed for final stage by clinical staging and by MR imaging, both of the mconcurred in 85.45% of cases and differed in 14.45% of cases. This result was comparable to the study of Nisha Unni *et al*., [12] who got a concordance rate of 85% and discordance rate 15%. The concordance rate of present study was comparable to study conducted by Shirazi AS *et al.*, [3] in 2014 who got a concordance rate of 88% obtained between clinical staging and MRI and the discordance rate was almost comparable to the study conducted by Dhoot NM *et al*., [19] who got a discordance rate of 34%.

Although no pregnant females were there in our study several studies have been done regarding the role of MRI in staging cervical cancer detected during pregnancy. One such study conducted by Balley quier C [20] concluded that MRI is an essential examination for planning the treatment of cervical cancers diagnosed during pregnancy.

The most important issue in staging of cervical cancer is to distinguish early disease that can be treated with surgery from advanced disease that must be treated with radiation alone or combined with chemotherapy. MRI is the best single imaging investigation that can accurately determine tumor location, tumor size, depth of stromal invasion, and extension into the lower uterine segment.

LIMITATIONS

Our study just aimed to suggest MRI as a single investigation of choice to stage carcinoma cervix if it was having good accuracy when compared with FIGO-clinical staging. MRI could not be done on patients with MR incompatible implants, pacemaker and claustrophobia.

CONCLUSION

From our result, we can say that, MRI is a noninvasive investigation with high sensitivity and specificity which can be used as a single investigation of choice for accurate staging of carcinoma cervix.

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