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Diagnostic Accuracy in Staging of Carcinoma Cervix Using Magnetic Resonance Imaging versus Clinical Staging

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Abstract
Cervical cancer is the second most common cancer for women world Wide. The management of the ca cervix depends on the stage of the disease, hence, accurate staging of the disease is necessary for the selection of therapeutic strategy. The current staging system, that is the FIGO clinical staging system, has got some limitation and inconvenience to the patient. It is inadequate in the evaluation of prognostic factors like tumor size, parametrial invasion and nodal status. MRI is a noninvasive method of imaging without using ionizing radiations. Recent technical advances in MR imaging and proven ability of MRI in evaluation of parametrial invasion, tumor size, lymph node metastasis made MRI an optimal option for evaluation of the main prognostic factors and selection of therapeutic strategy.

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 was a diagnostic test evaluation study involving 61 objects who were newly diagnosed cases of carcinoma cervix, already staged clinically by the FIGO system and referred to the radiology department for MRI imaging of pelvis during the period January 2016 to June 2017. MRI 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 analysis done by standard Chi square test. The sensitivity, specificity, positive and negative predictive values were obtained.*

Results: *In assessing whether the lesion was confined to cervix or extended beyond cervix sensitivity, specificity, PPV, NPV, & accuracy was 60%, 100%, 100% 92.7% and 93% respectively. In assessing the parametrial extension MRI had a sensitivity, specificity, PPV, NPV, & accuracy of 100%, 60%, 88.5%, 100%, 90.1% respectively. In assessing the bladder mucosal invasion MRI had a sensitivity, specificity, PPV, NPV, & accuracy of 100%, 94%, 78.6%, 100%, 95% respectively. In assessing the rectal mucosal invasion MRI had a sensitivity, specificity, PPV, NPV, & accuracy of 100%, 96.5%, 66.7%, 100%, 96.7% respectively. Clinical staging and MR staging concurred in 85% of cases and differed in 15% 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 pelvic lymphadenopathy, abdominal and inguinal lymphadenopathy, abdominal, pelvic metastasis as well as possibility of lung metastasis if pleural effusion or basal lung lesion were present.*

Keywords: *Carcinoma cervix, MRI carcinoma cervix, FIGO clinical staging.*

Introduction

Cervical cancer is the second most common gynaecologic cancer in women. Compared to other gynaecologic malignancies, cervical cancer develops in a younger population of women. Most early cancers are asymptomatic, whereas symptoms of advancing cervical cancer may include bleeding, watery discharge, and signs associated with venous, lymphatic, neural, or ureteral compression. The screening for this neoplasia with Pap smear sampling typically begins in adolescence or young adulthood. Diagnosis of cervical cancer usually follows colposcopic examination and histologic evaluation of cervical biopsies. Stage is the most important indicator of long-term survival and the treatment is typically according to the staging.

The most commonly used clinical staging system for cervical cancer is based on the International Federation of Gynecology and Obstetrics (FIGO) staging system[1]. This staging system has got some limitation and inconvenience to the patient. It relies on clinical examination and basic tests including cystoscopy, rectosigmoidoscopy, barium enema, intravenous urography, and chest radiographs. Some of these basic tests are using ionizing radiation and it is highly examiner dependent. Main limitations of clinical examination in staging cervical cancer are the prediction of tumor size, assessment of parametrial invasion and pelvic side walls as well as evaluation of adjacent organ involvement and lymphadenopathy.[2],[3].

MRI is a noninvasive imaging method without ionizing radiation and with proven ability in evaluation of cervical tumor, its parametrial invasion, tumor size and the lymph node metastasis. Hence, MRI provides an optimal option for evaluation of the main prognostic factors and selection of therapeutic strategy[4].

The sensitivity and specificity of MRI in assessing the metastases are very high, so if MRI is done, it may avoid the need for an examination under anaesthesia and the need of performing the other investigations in advanced disease[5],[6].

Materials and Methods

Our objective was to assess the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of magnetic resonance imaging in staging carcinoma cervix, as compared to clinical staging, which was taken as the reference.

Our study was a diagnostic test evaluation study involving patients who were newly diagnosed cases of carcinoma cervix, already staged clinically by the FIGO system and referred to the radiology department for MRI imaging of pelvis during the period January 2016 to June 2017.

The patient were directed from the gynaecology department after staging clinically by an expert and qualified gynaecologist from the Dept. of OBG, Govt Medical college Thrissur. A brief history from the patient recorded, and the consent regarding willingness to participate in the study was obtained .

MRI was performed on GE signa HDxt 1.5 Tesla unit. Patients were instructed to fast for 6 hours before examination to reduce small bowel peristalsis artifacts. Axial T2WI were obtained from the kidney to perineum using 256*256 matrix,32cm field of view(FOV), 4mm slice thickness,1mm interslice 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. All the data collected were coded and entered in in Microsoft Office Excel which was rechecked and analysed using SPSS Statistical software. The predictive stage for each patient was compared, with the clinical staging as reference.

Result

Table 1: MRI-FIGO comparison -size

		Size of the lesion in clinical staging		Total
		Confined to cervix	Extend beyond cervix	
Size of the lesion in MRI staging	Confined to cervix	6	0	6
	Extend beyond cervix	4	51	55
Total		10	51	61

Sensitivity = 60%, Specificity = 100%,
Positive predictive value =100% ,
Negative predictive value= 92.7%
Accuracy =93%

Table 2: MRI-FIGO comparison – parametrial invasion

		Parametrial invasion in clinical staging		Total
		Present	Absent	
Parametrial invasion in MRI staging	Present	46	6	52
	Absent	0	9	9
Total		46	15	61

Sensitivity = 100%, Specificity = 60%,
Positive predictive =88.5%,
Negative predictive value= 100%,
Accuracy =90.1 %.

Table 3: MRI-FIGO comparison-urinary bladder invasion

		Urinary bladder involvement in clinical staging		Total
		Present	Absent	
Urinary bladder involvement in MRI staging	Present	11	3	14
	Absent	0	47	47
Total		11	50	61

Sensitivity = 100%, Specificity = 94%,
Positive predictive value =78.6%,
Negative predictive value= 100%,
Accuracy =95 %.

Table 4: MRI-FIGO comparison-rectal invasion

		Rectal invasion in clinical staging		Total
		Present	Absent	
Rectal invasion in MRI staging	Present	4	2	6
	Absent	0	55	55
Total		4	57	61

Sensitivity = 100%, Specificity = 96.5%,
Positive predictive value =66.7%,
Negative predictive value= 100%, Accuracy =96.7 %

Table 5: MRI-FIGO comparison – overall staging

		Clinical staging				Total
		Stage I	Stage II	Stage III	Stage IV	
MRI staging	Stage I	6	0	0	0	6
	Stage II	3	26	3	0	32
	Stage III	0	0	7	0	7
	Stage IV	0	2	1	13	16
Total		9	28	11	13	61

Over all clinical and MRI staging concurred in 52 cases (85%), and differed in 9 cases (15%).

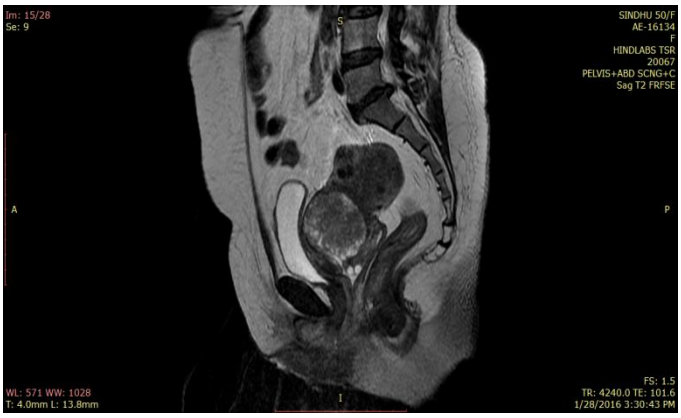

Figure 1 - Carcinoma cervix stage IB. Bulky cevix with a heterogenous endocervical mass. Cervical stromal invasion seen. No extension to parametrium or vagina. Enlarged right external iliac nodes noted.

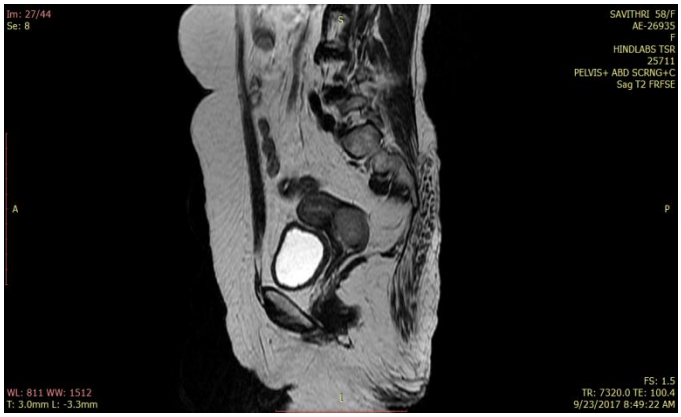

Figure -2a

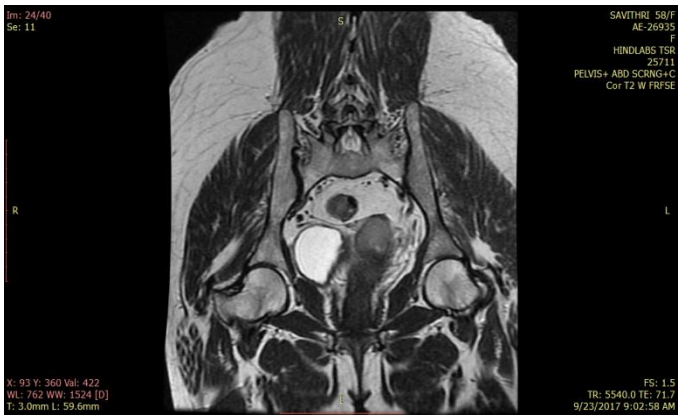

Figure -2b

Figure -2a, 2b Ca cervix Stage II B. Fairly defined intermediate to hyper intense lesion involving posterior lip of cervix. Slight extension to vagina and lower uterine segment. Bilateral parametrial fat stranding noted.

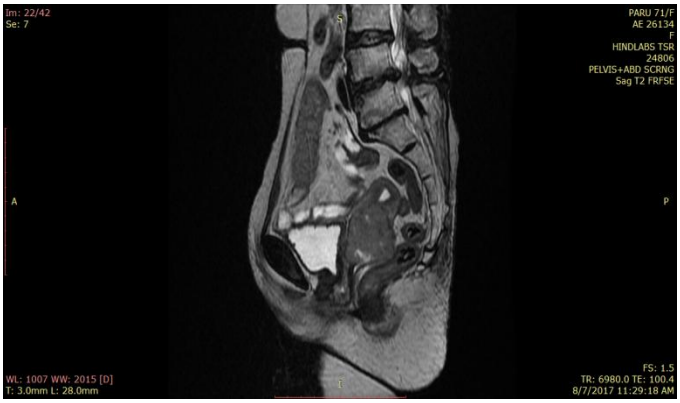

Figure -3a

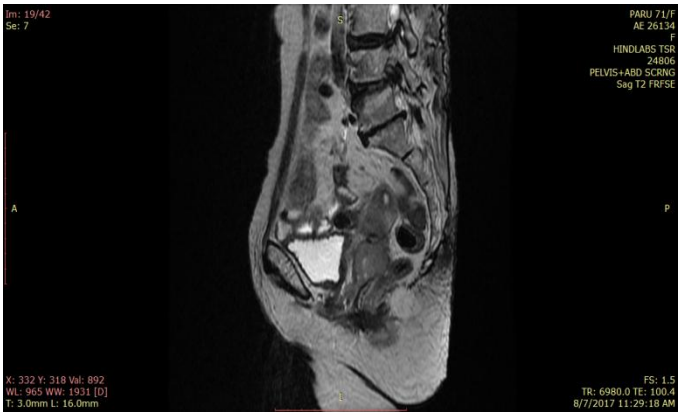

Figure -3b

Figure -3a, 3b Ca cervix Stage III A- Sagittal T2WI showing irregular circumferential thickening of cervix. Lesion is extending superiorly to uterine myometrium and inferiorly to vagina up to lower 1\3rd.

Discussion

In our 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 60%, 100%, 100% 92.7% and 93% respectively. P value was significant (<0.001). The accuracy rate of 93% in our study was comparable with the study of Kraljevic Z et al[7] who got an accuracy rate of 90.9%.

For assessing the parametrial invasion, MRI was shown to have a sensitivity of 100%, specificity of 60%, PPV of 88.5%, NPV of 100%, and accuracy of 90.1%. P value was significant (<0.001). According to the study of Zhang et al[6] the negative predictive value of MRI in detecting parametrial invasion was 100%.

MRI evaluation to assess bladder invasion showed the following statistical values. Sensitivity= 100%, Specificity = 94%, Positive predictive value =78.6%, Negative predictive value= 100%, and Accuracy =95 %. P value was significant (<0.001).

Rectal invasion assessment with MRI had Sensitivity = 100%, Specificity = 96.5%, Positive predictive value =66.7%, Negative predictive value= 100%, and Accuracy =96.7 %. P value was significant (<0.001). Our results were comparable with the study conducted by Kim WY[8] who found out that MRI sensitivity, specificity, positive and

negative predictive value and accuracy of bladder or rectum mucosal invasion were 100%, 96%, 41.2%, 100% and 96.1% respectively.

Therefore skipping cystoscopy or sigmoidoscopy based on the absence of invasion on MRI was safe enough without concern for understaging because MRI is highly sensitive with high negative predictive value in evaluating the bladder and rectal mucosal invasion.

When the sites of metastases were assessed clinically, especially by the help of supplementary investigations, pelvic lymph nodes (assessed by USG) was the most common metastatic site, which comes to about 80% of patients (26% of the study population) with metastatic disease. In MRI also we got a similar result of 80% (26% of the study population).Study conducted by Kim SH[9] also showed a comparable result of 22.3% of pelvic lymph node metastasis in the study population. Study conducted by Goro Kasuya[10] found that of the pelvic nodes, obturator nodes was the most commonly involved followed by external iliac> internal iliac > common iliac > presacral nodes.

When the patient was assessed for final stage by clinical staging and by MR imaging, both of them concurred in 85% of cases and differed in 15% of cases. This concordance rate was comparable to study conducted by Shirazi AS etal[5] 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[11] 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 Balleyquier C[12] concluded that MRI is an essential examination for planning the treatment of cervical cancers diagnosed during pregnancy.

Limitations

The main limitation of our study was that MRI staging was compared with the clinical staging, but the clinical staging was not a gold standard one. But it was the one which was recommended by FIGO and the one which was being followed in our institution. 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 clinical staging.

MRI could not be done on patients with MR incompatible implants, pacemaker and claustrophobia.

Conclusion

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.

For assessing the parametrial invasion, bladder and rectal mucosal invasion MRI was found to have a sensitivity of 100%.

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