ORIGINAL ARTICLE

Diagnostic Accuracy of Magnetic Resonance Imaging (MRI) in Detecting Parametrial Invasion in Carcinoma of Cervix

Jawad Ali[1], Adnan Ahmed[2], Aisha Yaqoob[3]

Author`s Affiliation

[1]Diagnostic Radiology Department of Kiran Hospital Karachi

[2]Assistant Professor of radiology department,
Liaquat University of Medical and Health Sciences Jamshoro (LUMHS)

[3]Senior registrar
Department of OBS and gynae
Sir Syed Hospital Karachi

Author`s Contribution

1Supervision and final approval
2,3Manuscript writing,4-6 Data collection
Data Analysis,

Address of Correspondence
Dr Adnan Ahmed
Email

ABSTRACT

Objective: To evaluate the diagnostic accuracy of MRI in the evaluation of parametrical invasion in carcinoma of the cervix using histopathological findings as gold standard.

Subject and Methods: This Cross-sectional study was conducted at diagnostic radiology department of KIRAN hospital Karachi; study duration was 12 months from December 2012 to November 2013. All the patients having carcinoma of cervix proven by the biopsy were included in the study. MRI scan was performed using MRI system (Toshiba aport, 0.35 Tesla) with the pelvic array coil for the scan of the pelvis. After MRI the patients are referred to a gynecologist for hysterectomy and then surgical specimen was reviewed by two experienced histopathologists and reported the positive/negative parametrium invasion on surgical specimen.

Results: The average age of the patients was 49.42 ± 8.92 years. Sensitivity and specificity was 81.7% and 82.2% respectively. Positive and negative predictive values were 86% and 77.1%, while the accuracy of MRI in detecting parametrial invasion was 81.9%.

Conclusion: It is concluded that MRI is a best diagnostic tool with high sensitivity, specificity and accuracy in detecting parametrial invasion of cervix carcinoma and its exact staging, size and location.

Key Words: Parametrical invasion, carcinoma of cervix, MRI

Introduction

Cervix carcinoma is the commonest malignancy among women.[1] Estimated total 371,200 cases diagnosed as cervix carcinoma year throughout the world or 9.8% from all types of women cancer.[2] Invasive cancer of the cervix is commonest in the developing countries including Pakistan.[2] No accurate data regarding ca cervix incidence in Pakistan exist, however, 65 new cases annually are reported in a single institutional study.[3] Invasive cervical cancers are leading cause of the mortality throughout the world. As about 190,000 deaths occur per year globally.[2]

Three treatment options are available for the management of uterine cervical carcinoma i.e. surgical removal of the uterus (hysterectomy), chemotherapy and radiotherapy. Correct staging of the cervical cancer is essential for the accurate management planning and the selection.[4] Parametrium invasive is the commonest factor in carcinoma staging of

cervix and subsequent treatment (5). About 73% of the patients with carcinoma cervix expected to have parametrium invasion.[8] Patients with cervical cancer without parametrium invasion are labeled as stage IIA disease or lower and can be treated with the hysterectomy. Patients with cervical cancer having documented parametrium invasion are labeled as stage IIB or greater may best managed through radiotherapy and the chemotherapy combination only (not by hysterectomy).[9]

Recent staging system of the cervical cancer is based on the FIGO classification.[5] This system is the based on findings from clinical assessment or the patient's examination. Big difficulties in clinical assessment of cases having cancer of cervix occurred in the estimation of the tumor size, particularly if the tumor is primarily ended location of the cervix; the parametrical and pelvic sidewall invasion

assessment; lymph node and distant metastases assessment. Imaging modalities uses to assess the extent of the cervix cancer includes ultrasonography, barium enema, excretory urography, computed tomography (CT), lymphangiography, positron emission tomography (PET) and magnetic resonance imaging (MRI).

MRI is the radiations free and the noninvasive imaging tool which can diagnose parametrial invasion in cervix carcinoma cases early and accurately. It is the greater soft-tissue resolve is the single optimum modality for pre-operative cervical carcinoma staging. MRI may exactly diagnose the location of the tumor, it's size, depth of the parametrial invasion and lower segmental extension of the uterus.[10–13] Sensitivity and specificity of MRI in parametrial invasion diagnosis were stated as 80% and 96% respectively.[14] MRI also a good diagnostic tool in the assessment of lymph node metastases. Though much work has been done in detecting early carcinoma of cervix by MRI in developed countries but the data is scanty in this regard in our part of the world. The rationale of our study is that by performing MRI in cases having cervix carcinoma prior to operation, the gynecologist can change their decision regarding hysterectomy. The gynecologist may perform a hysterectomy if parametrium is free of tumor as detected by MRI and vice versa. The purpose of our study was to highlights the important role of MRI in detecting parametrium invasion in carcinoma of the cervix and makes aware this to gynecologists and oncologists of our region to the managed the patients accurately.

Methodology

This Cross-sectional study was conducted at diagnostic radiology department of KIRAN hospital Karachi. Duration of study was 12 months from December 2012 to November 2013. All the patients having carcinoma of cervix proven by the biopsy during 6 months, cancer confined to cervix on clinical examination, scheduled for hysterectomy within 1 month after MRI and no medical or surgical contra-indications to hysterectomy were included in the study

All the cases with inflammatory disease of cervix involving parametrium, pelvic cancers other than cervix involving parametrium, evidence of distant metastases and concomitant pregnancy were excluded.

The diagnostic criteria for the patients included in the study are patients having biopsy proven carcinoma of cervix. The source of the patients was patients referred to outpatient department (OPD) of KIRAN hospital Karachi for MRI scan.

After taking detailed history & clinical examination and written informed consent, MRI scan was performed using MRI system (Toshiba aport, 0.35 Tesla) with the pelvic array coil for the scan of the pelvis. Imaging protocol included "axial T1 weighted spin echo images with a large field of view and T2" weighted fast spin echo images in sagital and axial planes with small field of view. Images were interpreted by two experienced radiologists (working independently for more than five years) and were document positive/negative parametrium invasion. After MRI the patients are referred to a gynecologist for hysterectomy & then surgical specimen was reviewed by two experienced histopathologist & reported the positive/negative parametrium invasion on surgical specimen. The findings of MRI and histopathology were entered in the proforma

DATA ANALYSIS PROCEDURE: Data was analyzed by SPSS-16. Mean and standard deviation were estimated for age and duration of disease. Frequency and percentage were computed for marital status and locality (urban/rural). Sensitivity (SE), specificity (SP) "positive predictive value (PPV), negative predictive value (NPV) and accuracy of MRI" were calculated by taking histopathology as gold standard.

Results

A total of 105 patients with biopsy-proven carcinoma of cervix were included in this study. Most of the patient's age was between 46 to 60 years of age. Average age of the patients was 49.42 ± 8.92 years (95%CI: 46.10 to 51.45) similarly the average duration of disease was 3.12 ± 1.95 months (95%CI: 2.24 to 4.45) as shown in table I.

Table: I. Descriptive Statistics of Variables (n=105)			
Variables	**Mean ± SD**	**95%CI**	**Max- Min**
Age (Years)	49.42 ± 8.92	46.10 to 51.45	60-40
Duration of Disease (months)	3.12±1.95	2.24 to 4.45	6-2
No. of patients (%)			
Marital status Married Unmarried	70(66.7%) 35(33.3%)		
Residential status Rural Urban	60(57.1%) 45(43.9%)		

Out of 105 cases, 70(66.7%) women were married and 35(33.3%) were unmarried. Most of the patients 60(57.1%)

were from rural areas and 45(43.9%) were from urban areas. Table II

Table II: Diagnostic Accuracy of MRI In Evaluation of Cervical Cancer for Parametral Invasion (n=105)

MRI	Histopathology		Total
	Positive	Negative	
Positive	49	8	57
Negative	11	37	48
Total	60	45	105

Sensitivity	81.7%
Specificity	82.2%
PPV	86.0%
NPV	77.1%
Accuracy	81.9%

Out of all study cases, 57 cases were presented with carcinoma, and further, out of these cases, 49 were confirmed with carcinoma by histopathology. The "sensitivity, specificity, positive predictive value, negative predictive value" and accuracy of MRI in detecting parametrial invasion were 81.7%, 82.2%, 86% , 77.1% and 81.9% respectively as presented in table III.

Similarly, "sensitivity, specificity, positive predictive value, negative predictive value and accuracy" of MRI in detecting parametrial invasion were reported with respect to age groups; marital status, locality and duration of disease without a significant difference as presented in table IV.

Discussion

Uterine cervix cancer development certainly curable on early identification before its progression to the invasive cancer.[14-16] Though, invasive cervix carcinoma remains a disease of the significant morbidity, and also the commonest cause of

women deaths throughout the world, though the prevalence of mortality of invasive cervical carcinoma have declined considerably (especially in the countries there well-developed screening program).[17] Uterine cervix cancer may readily manage by surgery at early stages. Chemoradiation and radiation ctherapies are the reserved for high-risk early stage or progressive disease.[18] Imaging modalities may utilized for the cervical cancer includes ultrasonography, barium enema, lymphangiography, excretory urography and "computed tomography CT, magnetic resonance imaging MR, and the positron emission tomography "PET".

MRI is noninvasive and radiations free imaging technique that can diagnose parametrial invasion early and accurately in cases having carcinoma of the cervix. Imaging of the MRI by its higher soft-tissue resolution is a single best modality for the pre-operative cervical carcinoma staging. MRI can exactly determine the location of the tumor, size of tumor, depth of the parametrial invasion and extension into lower segment of the uterus .[10-13]

A total of 105 patients with biopsy-proven carcinoma of cervix patients were included with a mean age of 49.42 ± 8.92years similarly the average duration of disease was 3.12±1.95 months. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MRI in detecting parametrial invasion were 81.7%, 82.2%, 86 %, 77.1% and 81.9% respectively. Further, we also found that accuracy of MRI in detecting parametrial invasion did not statistically significant with respect to age groups, marital status, locality and duration of disease. Consistently in a retrospective study containing 135 females who underwent pre-operative MRI, and surgical treatment of endometrial carcinoma, MRI the sensitivity 72%, 93.2% specificity, PP) 89.8%, NP) 80.2%, (+LR) 10.7 and (−LR) 0.3.[19]

In this study patients showed the 81.7% sensitivity, 82.2% specificity, 86% positive predictive value, 77.1% NPV and

TABLE III: Diagnostic Accuracy of MRI in Valuation of Cervical Cancer with Respect to Characteristics (n=105)

Stratification of Variables	Cutoff	Sensitivity	Specificity	PPV	NPV	Accuracy
Age (years)	≤50	82.9%	86.7%	87.9%	81.3%	84.6%
	>50	80.0%	73.3%	83.3%	68.8%	77.5%
Marital Status	Married	77.8%	80.0%	87.5%	66.7%	78.6%
	Unmarried	93.3%	85.0%	82.4%	94.4%	88.6%
Locality	Urban	80.0%	80.0%	88.9%	66.7%	80.0%
	Rural	83.3%	83.3%	83.3%	83.3%	83.3%
Duration of Disease (Months)	2 to 3	80.0%	83.3%	88.9%	71.4%	81.3%
	4 to 6	90.0%	80.0%	75.0%	92.3%	84.0%

81.9% accuracy—respectively. Although we reported a comparable sensitivity and specify the city rates, our study PPV was higher and NPV lower to the above study. MRI may accurately diagnose the cervical involvement in the cancer of endometrium and allows the decision for the type of the hysterectomy.[19] In another study sensitivity estimates for parametrial invasion as 74% for MRI and 55% for CT, and for the involvement of lymph node, 60% and 43% respectively.[20]

On other hand MRI and CT was compared for the specificities for parametrial invasion and the involvement of lymph node, for the bladder and rectum invasion and the sensitivities of MRI were as 75% of bladder and 71% for rectum and there were higher compared with CT and the study concluded that for the staging of the cancer of cervix MRI is best tool of diagnosis as compared to CT.[20] In a study 30 women with histologically diagnosis of endometrium cancer underwent MRI and results suggested that sensitivity was 85%, specificity 76%, PPV of 73%, NVP of 87%, and accuracy was 80%, while contrast- enhance scans showed the 90% sensitivity, 80% specificity, 82% PPV, 89% NPV, and 85% accuracy.[21] For the cervical infiltration sensitivity was 75%, specificity 88%, PPV 50%, NPV 96%, and accuracy 87%, while contrast-enhanced scans showed, 100% sensitivity, 94% specificity, 75% PPV, 100% NPV, and 95% accuracy. Our study of 105 patients showed The study concluded sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MRI in detecting parametrial invasion were 81.7%, 82.2%, 86%(77.1%) and 81.9% respectively.[21] The findings of our study were comparable to accuracy rates of T2-weighted sequences and contrast-enhanced scans for myometrial invasion in the above study; however, the accuracy rates of cervical infiltration with T-2 weighted sequence was comparatively high and for contrast-enhanced scans, it was significantly higher in the above study. The difference is attributed to high sensitivity and specificity rates in the above study partly related to the quality of accurate diagnosis.[21] The identification of the cervical lymph node metastasis is important for management and prediction of prognosis of the lingual SCC. MRI has been increasingly utilized to assess the status of the cervical lymph node. This study explored the MRI feature of cervical lymph node metastasis from the lingual SCC, and to the investigate MRI role in the evaluation of this kind of the metastasis.[22] MRI may diagnose lymph node metastasis in levels III-V with high accuracy, while its diagnosis accuracy on levels I-II is affected by the sites, which weakens its clinical value.[22]

It is concluded that MRI is a best diagnostic tool with high sensitivity, specificity and accuracy in detecting parametrial invasion of cervix carcinoma. By this diagnostic tool may assess the exact location of tumor, size, depth of parametrial invasion and extension in the lower uterine segment. These results were comparable with the previous studies with slight variations. Based on our study design strengths and weakness, we recommend further exploration of diagnostic accuracy.

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