ORIGINAL ARTICLE

DIAGNOSTIC ACCURACY OF MAGNETIC RESONANCE IMAGING IN CARCINOMA OF CERVIX TAKING HISTOPATHOLOGY AS GOLD STANDARD

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PJR October - December 2019; 29(4): 222-227

ABSTRACT

INTRODUCTION: Cervical cancer is one of leading cause of death among deaths due to cancer in women in the developing world. MRI is comparatively a newer modality in evaluation in the diagnosis of the carcinoma of the cervix so its use is likely to result in better prognosis of the patient. In comparison with histopathology, sensitivity and specificity of MRI may be determined in a public sector hospital of metropolitan city which may be the true indicator of disease in our society. **OBJECTIVE:** To determine the accuracy of magnetic resonance imaging in diagnosis of the carcinoma of cervix taking histopathology as gold standard. **METHODS:** This prospective study was carried out in department of Radiology, Jinnah Postgraduate Medical Centre Karachi from December 12, 2017 to January 21, 2019. 305 patients fulfilling inclusion criteria were selected. The MRI scan of pelvis of these selected patients was performed. **RESULTS:** Mean (–SD) age was 42.4 (–7.1) years. Irregular vaginal bleeding was the most common clinical presentation of carcinoma of cervix found in 192 (62.9%). Sensitivity, specificity, positive predictive value and negative predictive value of MRI were 80%, 76.9%, 82.4% and 74.1% respectively. Diagnostic accuracy of magnetic resonance imaging was 78.7%. **CONCLUSION:** High sensitivity, specificity, and diagnostic accuracy of magnetic resonance imaging (MRI) in carcinoma of cervix makes preoperative MRI highly recommendable for work up and to determine the treatment strategy.

Key Words: Carcinoma of cervix, MRI, Histopathology, vaginal bleeding, CIN

Introduction

Cervical cancer remains one of the most common cancers in women in developing countries. Most patients with cervical cancer are asymptomatic at its early phase, while patients with advanced disease typically present with abnormal vaginal bleeding. It may help in early detection and better prognosis. Different grades of cervical intraepithelial neoplasia (CIN I, II, III) are curable entities, so early detection of lesion is very important.[1]

The overall accuracy of MRI in detecting carcinoma of cervix is said to be high.[2] Magnetic resonance imaging has been described as one of the most accurate, non invasive modality in evaluating cervical carcinoma. The prognosis of cervical cancer is determined not only by local position, but also by nodal status, tumor volume and depth of invasion.[3]

Histopathological evaluations of parametrium and lymph nodes were the gold standard for diagnosis. Preoperative MRI may be used for substituting conventional staging tests, thus place for MRI in determination of the stage of cervical cancer is there.[4] Our aim is diagnosis of carcinoma of cervix with or without involvement of involved lymph nodes. The results of MRI will be correlated with histopathology.[5]

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Submitted 20 October 2019, Accepted 30 November 2019

This study along with other studies, may lead to designing protocol having MRI recommendation as basic screening tool for cervical carcinoma.

Objective

The objective of this study was to deter-mine the accuracy of magnetic resonance imaging in diagnosis of the carcinoma of cervix taking histo-pathology as gold standard in a public sector hospital of Karachi Pakistan and to compare the results with international studies and contribute to literature by locally produced data in a public sector hospital of metropolitan city of Pakistan.

Operational Definitions

Diagnostic accuracy of MRI scan in detection of cervical tumors was determined taking histopathology as gold standard in terms of sensitivity, specificity, positive predictive value and negative predictive value.

MRI diagnosis of cancer:
Presence of an irregular area in the endocervical canal, appearing isointense on T1WI, hyperintense on T2WI and enhances on fat sat T2WI is suggestive of cervical carcinoma. (Normal is hypointense on T2WI).

Histopathological diagnosis of cancer:
Presence of atypical cells and squamous cell carcinoma pattern in the biopsy of cervix is taken as confirmed cervical mucosa tumor .

Patients and Methods

This study was carried out in department of Radiology, Jinnah Postgraduate Medical Centre, Karachi from Decmber 12, 2017 to January 21, 2019. Study was duly approved by institutional ethical committee.
Keeping expected sensitivity of 73%, specificity 60%, prevalence 0.25, confidence level as 95%, and the margin of error as 10%, estimated sample size calculated was 305 patients. Purposive non probability sampling technique was planned.

Inclusion Criteria:
Female patients in age range between 35-50 years with post coital bleeding, or patients with irregular vaginal bleeding for more than 2 months, or patients with post menopausal bleeding or patients with history of mennorhagia, and patient willing to be included in study and give consent were included in study.

Exclusion Criteria:
Female patients already diagnosed as Ca cervix, or on chemotherapy or on radiotherapy or patient having surgery of cervix or patient with carcinoma of uterus and patient with age range less than 35 years or greater than 50 years were excluded.

DATA COLLECTION PROCEDURE:
The study was conducted after the approval of study proposal from the ethical committee of the institution. All patients meeting inclusion criteria of history and not having exclusion criteria were selected for study after informed consent. The MRI scan of pelvis of selected patients were performed on **archieva nova dual philips** 1.5 tesla MRI machine by a trained MRI technician having more than 3 years experience. Sagittal images of T2 weighted, axial images of T1W & T2W and coronal images of T1W and T2 fat sat sequences of the affected region were taken. MRI scan of pelvis of the patients after being diagnosed as having features of Ca cervix on console during MRI examination were further evaluated and analyzed for having different patterns of involvement of the cervix. Images were protected on our work station (console) and were reviewed by 2 senior radiologists having 3 years post fellowship experience.
Bio data and contact information of patients were saved along with their clinical history on a performa.
MRI findings were also recorded on same purpose built profroma and correlated with histopathology report.
Data was entered and analyzed on SPSS 10.0 software. Descriptive statistics was used to summarize the continuous variable. Age was presented as mean – SD, while categorical variables were reported as frequency and percentages of cases of malignancy on MRI and gold standard histopathology . Effect modifier like age and history of multiple sexual partners were controlled through stratification to see the impact on these outcome variables.

Results

During the study period 305 patients by inclusion and exclusion criteria suspecting carcinoma of cervix were included in this study. Mean – SD age of patients was 42.4 – 7.1 years (Min - Max = 35 - 50), majority of patients had age between 35 - 44 years, 200 (66.9%).

Irregular vaginal bleeding was the most common clinical presentation of carcinoma of cervix found in 192 (62.9%) followed by Post menopausal bleeding in 96 (31.4%), Vaginal discharge in 64 (20.9%) and post coital bleeding in 56 (18.3%). 103 (33.7%) were having more than one symptom.

History of multiple sexual partners was recorded in 36 (11.8%) women.

Sensitivity, specificity, positive predictive value and negative predictive value for magnetic resonance imaging (MRI) were calculated by taking histopathology as gold standard which came to be 80%, 76.9%, 82.4% and 74.1% respectively. Diagnostic accuracy of magnetic resonance imaging was 78.7%. (Tab. 1)

In age range between 35 - 44 years sensitivity, specificity, positive predictive value and negative predictive value of magnetic resonance imaging were 80.7%, 74.1%, 81.4% and 73.2% respectively while in age > 44 years Sensitivity, specificity, positive predictive value and negative predictive value of magnetic resonance imaging were 79.2%, 75.4%, 74.5% and 80% and found not significantly different.

Similarly sensitivity, specificity, positive predictive value and negative predictive value of magnetic resonance imaging were calculated with respect to history of multiple sexual partners, and found not much different (sensitivity = 81.8%, specificity = 78.5%, positive predictive value = 85.7%, negative predictive value = 73.3%).

MRI	Histopathology	
	Positive	**Negative**
Positive	140 (TP)	30 (FP)
Negative	35 (FN)	100 (TN)

TP = True positive, FP = False positive, FN = False negative, TN = True negative

Sensitivity = 80%
Specificity = 76.9%
Positive predicted value =82.4%
Negative predicted value = 74.1%
Diagnostic accuracy = 78.7%

Table 1: Accuracy of magnetic resonance imaging in diagnosis of carcinoma of cervix taking histopathology as gold standard n=305

Discussion

Cervical cancer is one of the leading cause of death in women among the deaths due to different cancers in developing world. Over 80% of women with newly diagnosed cervical cancer live in developing countries; most are diagnosed with advanced disease.[6] Collettini (2011), Stenstedt (2011), and Zand (2007) had addressed the impact of MRI in the preoperative staging and management of uterine cervical cancer.[7,8,9] They had proposed that MRI should be considered the most reliable modality for preoperative staging and treatment workup of cervical cancer. It provides a one stop shop for local disease assessment and should be performed as part of the pre-treatment evaluation of the tumor larger than 2 cm and in obese or pregnant patients.[7,9] MRI is now a widely used imaging modality in the initial staging of primary cervical cancer. It has been given an appropriateness criteria rating of 8 (out of 9) by the American College of Radiology (ACR) in the staging of invasive cervical cancer.[10] In single-institution studies, MRI performs better than CT in the depiction of parametrial invasion and overall staging accuracy.[11,12] The overall staging accuracy of MRI ranges from 77 to 90%.[13,14] The accuracy for the detection of parametrial invasion on MRI ranges from 88 to 97%, sensitivity ranges from 44 to 100% and specificity ranges from 80 to 97%.[15,16] Preservation of the low signal intensity ring virtually excludes parametrial invasion with a negative predictive value of 94-100%.[17,18] However, the positive predictive value of disruption of the stromal ring is lower because it can be difficult to differentiate peritumoral edema from parametrial invasion, particularly in large tumors.

In this study, irregular vaginal bleeding was the most common clinical presentation of carcinoma of cervix 192 (62.9%) followed by post menopausal bleeding in 96 (31.4%). This incidence was nearly compatible with that of Collettini (2011) and Sahdev (2007), who reported frequency of bleeding about 80-90%.[7,17] In our study MRI was found as highly sensitive (80%) and specific (76.9%) in determining cervical cancer. Overall diagnostic accuracy was 78.7%. Results in study by Chung[4] were on higher side. Morimura (2000) reported that MRI showed higher specificity (99.2%) and higher sensitivity (88.5%) in detecting

	Our study	Chung[4]	Morimura[19]
Sensitivity	80%	100%	88.5%
Specificity	76.9%	89.1%	99.2%
NPV	74.1%	100 %	
Accuracy	78.7%	90.8%	

NPV: Negative predictive value

Table 2: Comparison of sensitivity, specificity, NPV and Diagnostic accuracy

cervical stromal invasion.[19] Morimura took multiple parameters in his study for observation. He observed and processed for statistical inferences data for both mucosal and stromal involvement using different modalities like cytology, endocervical curettage , MRI and hysteroscopy. From its[19] available results we took only those results narrated for MRI in stromal involvement to compare with our results.

In a review article by Liyanage.[2] The accuracy for the detection of parametrial invasion on MRI was quoted from 88 to 97%, while sensitivity in different studies was narrated as from 44 to 100% and specificity ranges from 80 to 97%. Parametrial invasion was excluded by observing preservation of the low signal intensity ring with a negative predictive value of 94-100% .

In study by Sahdev[17] for diagnosing parametrial invasion, specificity and negative predictive value (NPV) by MRI was said to be 97% and 100%, respectively.

Kim and Han (1997) focused more on vesical involvement in carcinoma cervix and reported a sensitivity, specificity, and NPV of 83%, 100%, and 100%, respectively.[20] Rockall (2006) postulated that the absence of bladder or rectal invasion can be diagnosed with sufficient confidence using MRI (NPV = 100%).[21] This obviates the need for invasive cystoscopic or endoscopic staging in the majority of patients with cervical cancer.[21] The recent study done by Nilu (2012), stated that the overall accuracy of MRI in diagnosing carcinoma of cervix was 89.3%.[22] It is comparable with our which was 78.7%.

In this study effect modifier like age and history of multiple sexual partners were controlled through stratification to see the impact on these outcome variables which as mentioned above in results are not significantly different. To summarize, MRI is a non-invasive optimal modality for preoperative evaluation of patients with suspected uterine cervical malignancy, not only for detecting and characterizing the tumor itself, but also for efficient assessment of the tumor invasion and abdominal and pelvic lymphadenopathy, with subsequent more accurate treatment planning. The results of this study suggest that MRI is highly accurate in detection, characterization, and staging of cancer cervix. Therefore , preoperative MRI is highly recommended to determine the treatment strategy.

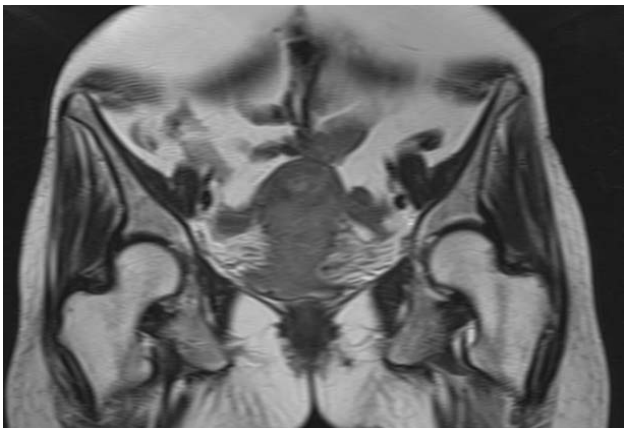

Figure 1: Carcinoma Cervix T2WI Coronal Section

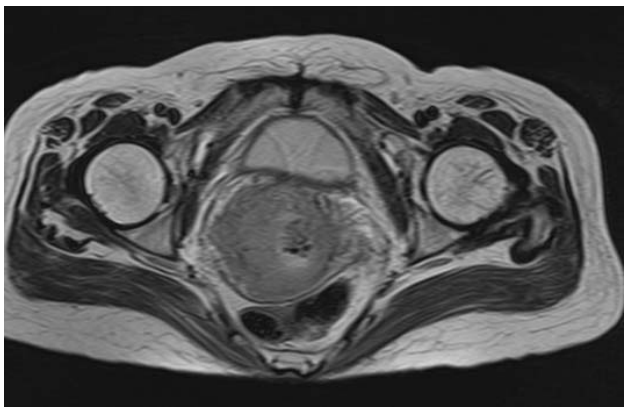

Figure 2: Carcinoma Cervix T2WI Axial view

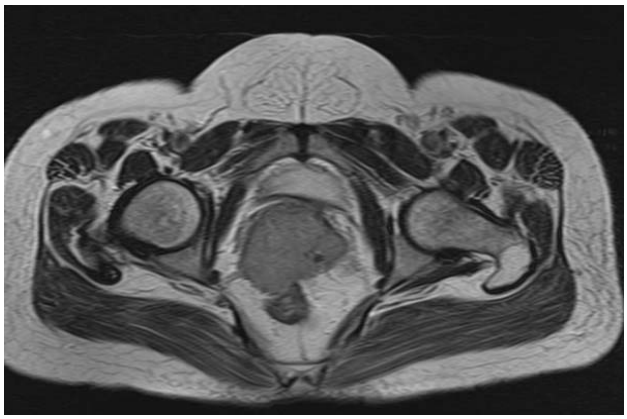

Figure 3: Carcinoma Cervix T2WI Axial view

Figure 4: Carcinoma Cervix FS pc Sagittal view

Figure 5: Carcinoma Cervix T2WI Sagittal view

Limitations of study

As only MRI pelvis was done for evaluating cervical carcinoma, nodal and metastatic spread in chest, abdomen and skeleton could not be included in the study.

Conclusion

High Sensitivity, specificity, positive predictive value and negative predictive value and diagnostic accuracy of magnetic resonance imaging (MRI) in carcinoma of cervix makes preoperative MRI highly recommendable for work up and for determining the treatment strategy.

Conflict of Interest: None

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