

Radiological Comparative Study of Carcinoma Cervix in CT and MRI

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ABSTRACT

Background: Carcinoma of cervix is the second most common cancer in woman worldwide. There is a potential role for accurate non-invasive staging of cervical carcinoma. For these reasons, CT and MR imaging may become more accurate substitute for clinical staging of cervical carcinoma.

Aim: The purpose of the study was to compare CT and MRI findings, in evaluation and staging of Uterine Cervical Carcinoma.

Materials and Methods: Patients presenting to the departments of Oncology and Gynaecology, Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar with clinical suspicion of Uterine Cervical Carcinoma who may or may not have had other screening investigations will be included in this study. The numbers of patients proposed to be included in the study are twenty.

Results: MR imaging has several other advantages over CT, such as high-contrast resolution and multiplanar capability which usually demonstrate well the relationship of the uterus, the vagina, the urinary bladder, and the rectum on Sagittal images. Our study illustrates few cases to show these advantages of MR imaging over CT.

Conclusion: We conclude that MR imaging should be used as routine for imaging study for preoperative staging of uterine cervical carcinoma.

Keywords: Cervical Carcinoma, CT, MRI, Preoperative Staging

INTRODUCTION

Carcinoma of cervix is the second most common cancer in women worldwide, today. In India, the annual incidence of carcinoma of cervix is estimated to be five lakhs new cases per year. Carcinoma of cervix accounts for 25-50% of total cancers while for 86-90% of all genital cancers in Indian women.

Uterine cervical carcinoma is one of the most frequent causes of death in women. Accurate staging of uterine cervical carcinoma is crucial in determining the mode of treatment. There is a potential role for accurate non-invasive staging of Cervical carcinoma. This is because clinical staging based primarily on pelvic examination,

cystoscopy, and proctoscopy is inaccurate, and because surgical staging for clinical stages II to IV generally is not routinely performed and has significant morbidity. Up to 12% of patients with clinical stage I disease will have a planned Hysterectomy aborted by intra operative findings, usually gross extension of pelvic disease or periaortic lymphadenopathy. Patients treated with radiation therapy only, for example those with stage II and III, may be under stage or over stage, with effects on mortality. For these reasons, CT and MR imaging may become a more accurate substitute for clinical staging of cervical carcinoma.

Squamous cell carcinoma of the cervix and its intraepithelial precursor follows a pattern typical of

sexually transmitted disease. Molecular and epidemiologic studies have demonstrated a strong relationship between human papillomavirus (HPV), cervical intraepithelial neoplasia (CIN) and invasive carcinomas of the cervix. ^[1,2]

MATERIALS AND METHODS

Patients presenting to the Departments of Oncology and Gynaecology, Chalmeda Anand rao Institute of Medical Sciences with clinical suspicion of Uterine Cervical Carcinoma who may or may not have had other screening investigations will be included in this study. The numbers of patients proposed to be included in the study are twenty

Techniques:

CT: CT Images of the pelvis will be obtained on a Seimens Somatome Scope 16 slice Computed Tomography scanner. Matrix size of 512 * 512 and slice section of 1.5mm.

MR IMAGING TECHNIQUE

MRI was performed on the 1.5 Tesla system (GE Healthcare) using a pelvic array coil for the pelvic scan and a torso phased- array coil for the paraaortic scan. Scans were obtained using the following parameters for the pelvic region:

Axial T2- weighted fast spin-echo sequence (5,000/68; slice thickness 3 mm; interslice gap 1 mm; field of view 24 x 24 cm; matrix, 256 x 192; echo-train length 21; signals acquired 4; no fat saturation; bandwidth 31.25 kHz). Sagittal T2-weighted fast spin-echo sequence (5,000/68; slice thickness 3 mm; interslice gap 3 mm; field of view 24 x 24 cm; matrix 256 x 192; echo-train length 26; signals acquired 4; no fat saturation; bandwidth 31.25 kHz). Coronal T2-weighted fast spin-echo sequence (5,000/68; slice thickness 3 mm; interslice gap 3 mm; field of view 24 x 24 cm; matrix 256 x 192; echo-train length, 26; signals acquired 4; no fat saturation).

STATISTICAL ANALYSIS

The data was analyzed by the SPSS software and to compare the efficacy of study of carcinoma cervix in CT & MRI.

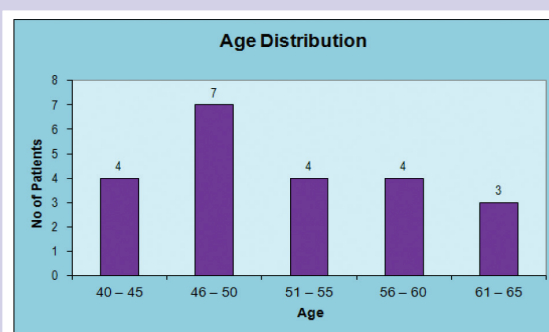
RESULTS

The present study was on the patients presenting to the department with clinical suspicion of uterine cervical carcinoma. Data was collected and analyzed from a total of 20 patients of different age groups.

Table 1: Age Distribution

Age	No of Patients
40 – 45	4
46 – 50	7
51 – 55	4
56 – 60	4
61 – 65	3

Age distribution chart shows the average age of incidence of carcinoma cervix in this study was between 40 to 65 years with peak incidence between 46 to 50 years (Table 1).

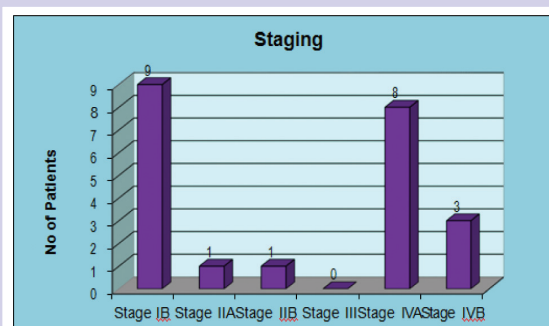


Graph 1: Age Distribution

Table 2: Staging

Stage	No of Patients
Stage IB	9
Stage IIA	1
Stage IIB	1
Stage III	0
Stage IVA	8

The present study, most of the cases were of stage IB with stage IVA being the next common stage. Only one case each of Stage IIA and IIB were seen in this study (Table 2).

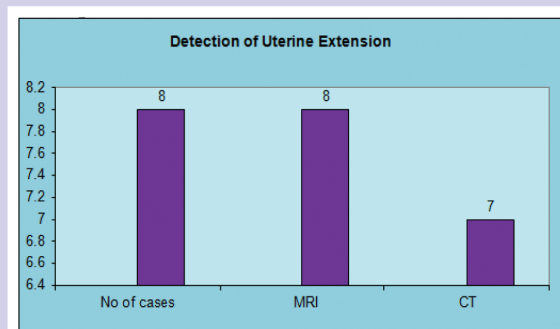


Graph 2: Staging

Table 3: Detection of Uterine Extension

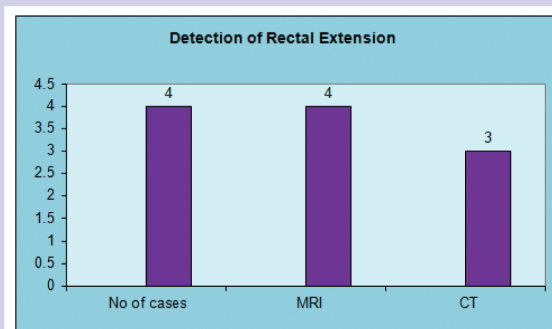
No. of Case of Uterine Extension	No. of Cases detected by MRI	No. of Cases detected by CT
8	8	7

A Total of eight cases of uterine extension were found in our study of which CT missed to pick up in one case, which was visualized on MRI (Table 3 & Graph 3).

**Graph 3: Detection of Uterine Extension****Table 5: Detection of Rectal Extension**

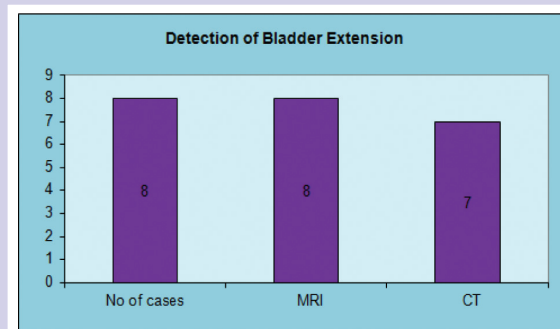
No of cases of rectal Extension	No of cases Detected by MRI	No of cases Detected by CT
4	4	3

Rectal extension was seen in four cases in this study which was detected by MRI but CT failed to detect in one case. (Table 5 & Graph 5).

**Graph 5: Detection of Rectal Extension****Table 4: Detection of Bladder Extension**

No of cases of Bladder Extension	No of cases Detected by MRI	No of cases Detected by CT
8	8	7

A total of eight cases of bladder extension were found in this study with MRI picking up all the eight cases but CT missed one case. (Table 4 & Graph 4).

**Graph 4: Detection of Bladder Extension****Table 6: Detection of Parametrial Extension**

No of cases of Parametrial Invasion	No of cases Detected by MRI	No of cases Detected by CT	
		False positives	True cases
4	4	3	4

In this study a total of four cases of parametrial invasion were found and MRI detected all the cases. CT showed seven cases out of which three were false positives. (Table 6 & Graph 6).

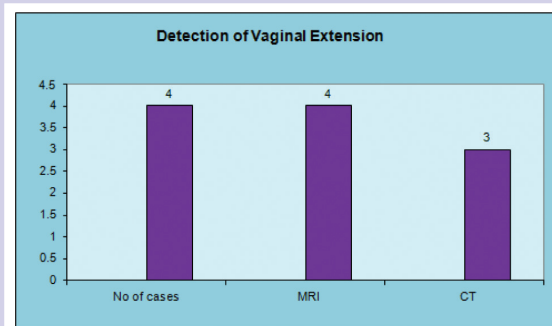
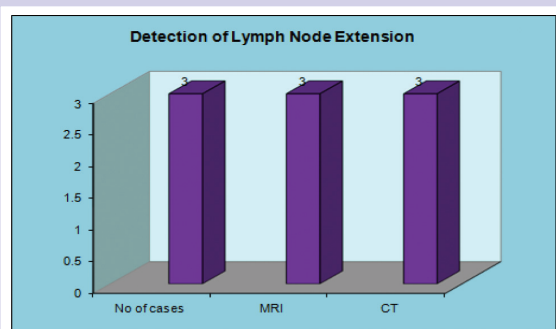
**Graph 6: Direction of Vaginal Extension**

Table 7: Detection of Vaginal Extension

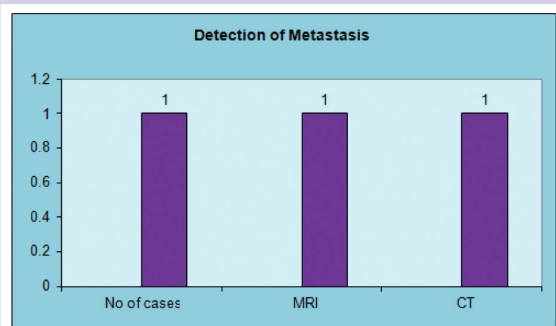
No of cases of rectal Extension	No of cases Detected by MRI	No of cases Detected by CT
4	4	3

Vaginal involvement was seen in four cases out of which CT missed to pick up in one case which was visualized on MRI (Table 7 & Graph 7).

**Graph 7: Detection of Lymph Node Extension****Table 8: Detection of Lymph Node Extension**

No of cases of lymph node involvement	No of cases Detected by MRI	No of cases detected by CT
3	3	3

Three cases of lymph node involvement was seen in this study which was detected both by MRI and CT. In two cases pelvic lymph nodes were involved and in another case inguinal lymph node involvement was detected (Table 8 & Graph 8).

**Graph 8: Detection of Metastasis****Table 9: Detection of Metastasis**

No of cases with metastasis	No of cases Detected by MRI	No of cases Detected by CT
1	1	1

In this study only one case of metastasis was detected, and it was to the liver. It was detected by both MRI and CT (Table 9).

DISCUSSION

From December 2019 to June 2021 twenty two patients diagnosed of cervical carcinoma were examined with both CT & MR imaging at our hospital. Uterine cervical carcinoma was diagnosed histologically in nineteen patients. The other three patients were previously diagnosed cases of carcinoma, out of which two had undergone hysterectomy and one had radiation therapy. They were referred with a suspicion of recurrence.

CT staging and MR staging were based on previously reported criteria. At CT and MR, a tumor was considered stage IB when a tumor was not seen or was confined to the cervical stroma. At CT, a tumor was considered stage IIA when the upper portion of the vagina showed wall thickening or eccentric mass formation. At MR imaging when loss of the low signal intensity of the normal vaginal wall was seen, especially on T2 weighted Sagittal images, the tumor was considered stage IIA.

At CT, a tumor was considered stage IIB when there was irregularity or poor definition of the lateral cervical margins, prominent parametrial soft- tissue strands, obliteration of the periureteral fat plane, or an eccentric parametrial soft- tissue mass. At MR imaging, a tumor was considered stage IIB when there were areas of abnormal signal intensity, within the parametrial region with complete loss of the low signal intensity of normal cervical stroma.

At CT and MR imaging, a tumor was considered stage IIIA when stage IIA findings were seen to extend to the lower third of the vagina. At CT and MR imaging a tumor was considered stage IIIB when stage IIB findings were seen to extend to the pelvic side wall. At CT, a tumor was considered stage IVA when there was loss of the perivesical-perirectal fat plane, asymmetric wall thickening, nodular indentation or serrations along the walls of the bladder and rectum, or intraluminal tumor mass.

At MR imaging, tumor was considered stage IVA when there was loss of the low signal intensity of the normal bladder or rectal wall, especially on T2 weighted sagittal

images. At both CT and MR imaging, pelvic lymph nodes were considered to be abnormal if they were greater than 1.0 cm in diameter.

Tumor detection

In our study tumor was visible in all the cases both on CT and MR images probably because the size of the tumor was big enough by the time of diagnosis. On T2 weighted images, twenty tumors showed higher signal intensity than did normal cervical stroma. On CT, tumors appeared isodense or mixed dense with the cervical stroma and bulky cervix. This is the limitation in our study for we did not have any cases of Stage IA cases for comparing the percentage of tumor detection by CT and MRI in the early stage.

Parametrial evaluation

In a study done by Vick et al which included sixteen patients of newly diagnosed cases of cervical carcinoma, false positive cases of parametrial involvement was high on CT when the criteria of prominent parametrial strands were used as compared to the irregular lateral cervical margins and parametrial mass.^[3] The accuracy rate was only 58%. In another study conducted by SH Kim et al which included thirty patients diagnosed of uterine cervical carcinoma, comparison of CT and MR findings were done.^[4] Twelve patients had parametrial involvement out of which MR had an accuracy of 92% as compared to 70% of CT.

In our study parametrial involvement was seen in seven patients at CT, out of which three cases showed intact cervical stroma on MR and four patients showed parametrial involvement at MR imaging, suggesting three false- positive cases detected on CT. This is a significant finding for the staging will be altered and so is the treatment.

Staging

In a study conducted by Seung Hyup Kim et al the overall accuracy in tumor staging was 63% for CT and 83% for MRI as compared to clinical staging. The down staging rate was 10% and upstaging rate was 27% for CT.^[2]

In another study done by Kim SH et al in ninety nine patients of cervical carcinoma MRI was superior in over all staging with 77% accuracy as compared with 69% accuracy on CT. In our study which consisted of twenty two patients nine patients were staged as Stage IB, one case each of Stage IIA and Stage IIB, seven cases of Stage IVA and three cases of stage IVB.

The limitation in our study is we did not have any case of Stage III and also no cases were of Stage IA. CT over-estimated the staging in four cases as compared to MRI

by suggesting parametrial involvement in three cases and bladder involvement in another case, which on MR imaging were staged correctly due to the presence of the intact stromal ring and well preserved perivesical plane. In three cases CT under staged the case because vaginal extension in one case, bladder extension in one case and rectal extension in another case was not detected. Vaginal extension was detected on MRI in the sagittal images involving the anterior wall of vagina. Rectal and bladder involvement was detected on MR imaging by effacement of perirectal and periveiscal fat plane. Hence the down staging percentage on CT was 18% and upstaging percentage was 13% which differs from the study done by Seung Hyup Kim et al probably because of comparison with clinical staging and also due to Stage I cases being more in their study. [2] The accuracy of CT in staging of cervical carcinoma is only 72% in our study which is almost same compared with the study done by Kim SH et al. ^[2]

Uterine evaluation

In our study a total of eight cases of uterine extension were found in our study of which CT missed to pick up in one case, which was visualized on MRI. In a study done by Mitchell DG et al, in 208 patients biopsy proven invasive cervical carcinoma. They concluded MRI is superior to CT for evaluating uterine body invasion.^[6]

Lymph node evaluation

In our study only two case of pelvic lymph nodal involvement was seen and it was detected on both CT and MR imaging. One more case of inguinal lymph node was seen and again it was detected on both CT and MR imaging. However, in previous studies done by JW Walsh and DR Goplerud ^[10], Kim SH, et al ^[2], Togashi K, et al ^[7], Bellomi M, et al ^[9] the accuracy of detection of lymph node involvement by CT and MRI was almost same and probably because the size of the lymph node is taken as the criteria.^[9] Although detection will help in proper treatment planning the detection of lymph node involvement will not change the staging.

Metastasis

In our study we had only two cases of distant metastasis one is involving the liver and the other involving the inguinal lymph node. However, inguinal lymph node involvement is seen. In a study done by Walsh JW and Goplerud DR in seventy five patients with diagnosis of cervical carcinoma, two cases had inguinal lymph node involvement. ^[10]

Recurrent Tumor

In our study two cases of post operative recurrence were seen and one case of post radiation therapy was seen.

One case each of post radiation therapy recurrence and post operative recurrence case were staged at IVA both by CT and MR imaging. One more case of post operative recurrence was staged as IB. However, CT could not differentiate an irradiated uterus from central tumor recurrence which was better appreciated at MR imaging. Misciasci T et al analysed the CT and MRI on follow up a patient with recurrent cervical carcinoma treated with radiotherapy, they concluded MRI is the procedure of choice in follow up.^[8]

CONCLUSION

Clinical staging has limited accuracy, especially in cases of advanced disease. To improve diagnostic accuracy in staging and identification of lymph node metastasis of uterine cervical carcinoma, CT has been used with several limitations. One of the most frequent and significant staging errors that arise with use of CT is false-positive diagnosis of parametrial invasion by the tumor. Recently several studies have emphasized the value of MR imaging as a preoperative diagnostic and staging modality in cases of uterine cervical carcinoma, because of better delineation of primary cervical carcinoma and parametrial tumor extension than is possible with CT. We wanted to study the advantages of MR imaging in comparison with CT.

One of advantages of MR is in its ability to pick up lesions very early as compared to CT. The greatest impact of MR imaging on the staging of uterine cervical carcinoma is in the evaluation of parametrial status, which has been one of the most significant limitations of CT staging. In our study the accuracy of parametrial evaluation of CT was much less when compared to MR imaging. Hence it is possible to infer from this prospective study that MR imaging is superior to CT in the evaluation of parametrial status, which is one of the most crucial points in pre operative staging of uterine cervical carcinoma.

Overall, the accuracy rates of CT and MR imaging for pelvic lymph node metastasis were equal in our study. This result agrees with the findings in other reports.

MR imaging has several other advantages over CT, such as high- contrast resolution and multiplanar capability which usually demonstrate well the relationship of the uterus, the vagina, the urinary bladder, and the rectum on sagittal images. Our study illustrates few cases to show these advantages of MR imaging over CT. At this point, we conclude that MR imaging should be used as routine for imaging study for preoperative staging of uterine cervical carcinoma.

CONFLICT OF INTEREST:

The authors declared no conflict of interest.

FUNDING: None

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