



MR IMAGING OF CARCINOMA CERVIX

Dr. Bhavani Bangaru	MD, Assistant Professor, Department of Radiology, kakatiya medical college, warangal.
Dr. Pilli Srujana	MD, Assistant Professor, Department of Radiology, kakatiya medical college, warangal.
Dr. Shaik Ameenulla Hafeezuddin*	MD, Assistant Professor, Department of Radiology, kakatiya medical college, warangal. *Corresponding Author

ABSTRACT Cervical cancer is the most common gynecological oncology in the world. Every year more than 500,000 cases are diagnosed cervical cancer worldwide and over one third of patients in advanced stage suffer recurrence. To compare CT and MRI findings, in evaluation and staging of Uterine Cervical Carcinoma present study done in the departments of Oncology & gynaecology, Cancer Hospital ,Chalmeda Ananda Rao Institute of Medical Sciences, Karimnagar over 20 patients. 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.

KEYWORDS : carcinoma cervix, extension, metastasis

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. With the high rate of incidence and relapse, cervical carcinoma becomes the major threat to women's health. Several prognostic factors for cervical cancer have been identified, including International Federation of Gynecology and Obstetrics (FIGO) staging, histological subtype, differentiated histology, pelvic and para-aortic lymph node metastasis. However, these risk factors can be identified from surgical specimens only. A noninvasive method for assessing tumor staging and pathological features would be useful. PET/CT and MR imaging are advanced imaging techniques frequently used in clinic. Currently, they have achieved more favorable positions in evaluating cervical carcinoma and directing approach to therapy. 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.

AIMS AND OBJECTIVES

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

Special emphasis on:

1. Detection of earliest lesion (in size).
2. Staging
3. Parametrial Assessment
4. Early vaginal and uterine invasion
5. Urinary bladder and rectal invasion.
6. Post radiotherapy changes like fibrosis and recurrence.

MATERIALS AND METHODS

Patients presenting to the departments of Oncology & gynaecology, Cancer Hospital ,Chalmeda Ananda 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**Age Distribution**

Age distribution shows 4 cases in 40-45 years, 7 cases in 46-50 years, 4 cases in 51-55 years, 4 cases in 56-60 years, 3 cases in 61-65 years. 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.

Staging

In this study most of the cases (9 cases) were of stage IB with stage IVA being the next common stage (8cases). Only one case each of Stage IIA and IIB were seen.

Detection of Uterine Extension

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 visualised on MRI

Detection of Bladder Extension

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.

Detection of Rectal Extension

Rectal extension was seen in four cases in this study which was detected by MRI but CT failed to detect in one case.

Detection of Parametrial Extension

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.

Detection of Vaginal Extension

Vaginal involvement was seen in four cases out of which CT missed to pick up in one case which was visualized on MRI.

Detection of Lymph Node Extension

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.

Detection of Metastasis

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

DISCUSSION

From December 2014 to September 2016, 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.

The ages of the patients ranged from 40 to 63 years (mean, 48 years) with peak incidence being in the age group of 45 – 50 years. This data is agreed by most of the previous studies done earlier.

Tumor detection

Lee et al. reported a series of 56 patients with cervical cancer who were prospectively assessed with 18F-FDG PET/CT and contrast-enhanced CT or contrast enhanced CT/MR imaging. Their conclusion was that sensitivity of PET/CT (69%) in detection of primary tumors was higher than that of contrast-enhanced CT (16%) ($P < 0.001$) or contrast-enhanced CT/MR imaging (41%) ($P = 0.039$), while specificity of these methods did not differ (88%, 76%, and 59% for PET/CT, contrast-enhanced CT, and contrast-enhanced CT/MR imaging, respectively; $P > 0.4$)¹. Another review summarized that FDG-PET was able to detect 99% of primary cervical cancers with hydration, diuretics and bladder drainage for reducing urinary activity².

Maximum standardized uptake value (SUVmax), which classifies the ability of tumor glucose metabolism into different levels, performs the visual qualitative and quantitative analysis of PET/CT. Kidd et al. found the relationship between FDG uptake and histologic features and differentiation in 2009. It is reported that squamous cell tumors had a significantly higher SUVmax than non-squamous cell cancers, and a higher SUVmax was also demonstrated in poorly differentiated tumors²⁵.

Magnetic resonance (MR) imaging is another practical tool for cervical cancer, especially when we need to assess its size, location, and extension into the surrounding tissues. It is found that the correlation coefficient of the three-dimensional (3D) tumor volume measurement using T2W imaging was 0.96 in the surgery group with and without neoadjuvant chemotherapy respectively⁵. In a single-centre experience, Rizzo et al. concluded that pre-surgical MR is accurate (80%) in evaluating the minimum thickness of uninvolved cervical stroma; and the maximum depth of stromal invasion measured by MR differed ± 9 mm from the pathological results in 95% of cases⁶. The sensitivity of MR imaging in the evaluation of bladder and rectal invasion is 71–100%, with a specificity of 88–91%, and a negative predictive value of MR imaging approaching 100%. And this remarkable result can help us avoid overestimating local invasion into the parametrium, bladder, and rectum. Moreover, Kusmirek et al. once compared clinical staging with MR imaging in the accuracy rates for cervical cancer patients staging IB or greater and concluded that MR imaging, of which accuracy rates approaching 95% for stage IB or greater, is more accurate for cervical cancer beyond early stages⁷. However, in early stage disease, clinical staging is still the most accurate.

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 al¹² 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. The accuracy rate was only 58%. In another study conducted by Seung Hyup Kim et al¹³ which included thirty patients diagnosed of uterine cervical carcinoma, comparison of CT and MR findings were done. Hrikak H et al¹⁴ suggested parametrium invasion to be present with disruption of the full thickness of the stroma combined with one or more of following findings: irregular interphase between the tumour and parametrium, asymmetric bulged or vascular encasement. They concluded that MR imaging should become the initial examination of choice to rule out early parametrial invasion.

Lam WW et al¹⁵ in their study concluded that dynamic T1-weighted images are inferior to STIR and FSE T2-weighted sequences. STIR is

often of similar value in the detection of parametrial invasion in Ca Cervix as a FSE T2-weighted sequence; their simultaneous use is not justified.

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 al¹³ the overall accuracy in tumor staging was 63% for CT and 83% for MRI as compared to clinical staging. The downstaging rate was 10% and upstaging rate was 27% for CT. In another study done by Kim SH et al¹⁶ in ninety nine patients of cervical carcinoma MRI was superior in overall 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 understaged 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 perivesical fat plane. Hence the downstaging percentage on CT was 18% and upstaging percentage was 13% which differs from the study done by Seung Hyup Kim et al¹³ probably because of comparison with clinical staging and also due to Stage I cases being more in their study. 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 al¹⁶.

Uterine and vaginal involvement

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 visualised on MRI. In a study done by Mitchell DG, Synder B et al¹⁷, in 208 patients biopsy proven invasive cervical carcinoma. They concluded MRI is superior to CT for evaluating uterine body invasion.

MRI is highly sensitive in the detection of vaginal invasion, with 93% accuracy¹⁸. Additionally, the use of intravaginal ultrasonographic gel during the MRI acquisition is recommended to distend and fill the cavity with a highly hyperintense material on T2-weighted sequences in order to improve the tumor contrast (slightly hyperintense on T2-weighted sequences) and the vaginal wall contrast (hypointense on T2-weighted sequences). This procedure improves the sensitivity in the evaluation of the vaginal invasion. About 20 ml of gel applied at the moment of the examination are sufficient.

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 James W Walsh and Dean R Goplerud¹⁹, Kim SH, et al¹³, Togashi K, et al²⁰, Bellomi M, et al²¹ 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. 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 involving the liver and the other involving the inguinal lymph node. However, inguinal lymph node involvement is seen. In a study done by Walsh and Goplerud¹⁹ in seventy five patients with diagnosis of cervical carcinoma, two cases were having inguinal lymph node involvement.

Recurrent tumor

Hrikak H²² studied the value of MR after radiation therapy for 69

patients of Ca Cervix. Diagnosis of recurrence was best with unenhanced T2-weighted sequences, but in patients with adnexal or pelvic side wall recurrence and in patients with treatment complications contrast enhancement did help.

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 al²³ 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.

CONCLUSIONS

From December 2014 to September 2016, Twenty Two patients who were diagnosed of uterine 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 cervical carcinoma, out of which two had undergone hysterectomy and one had radiation therapy. They were referred with a suspicion of recurrence.

The ages of the patients ranged from 40 to 63 years with mean age being 48 years. The peak incidence was seen in the age group of 45 – 50 years. This data is agreed by most of the previous studies done earlier.

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. In our study all the patients underwent both MR and CT imaging.

It is a limitation in our study that we did not have any case of stage IA, there by we could not assess and compare the tumor detection rate by MR and CT imaging. One of advantages of MR is in its ability to pick up lesions very early as compared to CT. Both MR and CT picked up all the lesions in our study due to tumor growth being visible at the time of diagnosis. Probably this is due to lack of awareness in our population about the importance of regular check up and early detection.

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.

In one case of post radiation therapy recurrence in our study CT could not differentiate between the central tumor mass and the irradiated uterus. This was better seen on MR imaging which again has the ability to differentiate between fibrosis and recurrence.

The study shows considerable promise in the use of ADC values to evaluate treatment response of cervical carcinoma, especially in detecting early response after 14 days of treatment. This non-invasive, non-contrast and non-ionising radiation, functional imaging technique might in future contribute to more advances in oncological therapy.

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.

REFERENCES

- Vizcaino AP, Moreno V, Bosch Fx, Munoz N, Barros-Dios XM, Parkin DM. International trends in the incidence of cervical cancer.
- Adenocarcinoma and adenosquamous cell carcinomas. *Int J Cancer* 1998;75:536.
- Zheng T, Holford TR, Ma Z, et al. The continuing increase in adenocarcinoma of the uterine cervix: a birth cohort phenomenon. *Int J Epidemiol* 1996;25:252.
- Thomas DB, Ray RM. Oral contraceptives and invasive adenocarcinomas and adenosquamous carcinomas of the uterine cervix. The World Health Organization Collaborative Study of Neoplasia and Steroid Contraceptives. *Am J Epidemiol* 1996;144:281.
- Ursin G, Peters RK, Henderson BE, et al. Oral contraceptive use and adenocarcinoma of cervix. *Lancet* 1994;344:1390.
- Stubblefield PG. Oral contraceptives and neoplasia. *J Reprod Med* 1984;29:524.
- Bergeron C, Barrasso R, Beaudenon S, et al. Human papillomaviruses associated with cervical intraepithelial neoplasia. Great diversity and distinct distribution in low and high-grade lesions. *Am J Surg Pathol* 1992;16:641.
- Durst M, Gissman L, Ikenberg H, Hausen H. A papillomavirus DNA from a cervical carcinoma and its prevalence in cancer biopsy specimens from different geographic regions. *Proc Natl Aca Sci U SA* 1983;80:3812.
- Richard RM, Masood S, Syrjanen KJ, et al. Human papillomavirus. International Academy of Cytology Task Force summary. Diagnostic cytology towards the 21st century: an international expert Conference and Tutorial. *Acta Cytol* 1998;42:50.
- Schiffman MH. Recent progress in defining the epidemiology of human papillomavirus infection and cervical neoplasia. *J Natl Cancer Inst* 1992;84:394.
- Burge RA, Monk BJ, Kurosaki T, et al. Human papillomavirus type 18: association with poor prognosis in early stage cervical cancer. *J Natl Cancer Inst* 1996;88:1361.
- Bezerra MRL, Soares AFF, Faintuch S, et al. Identificação das estruturas músculo-ligamentares do assoalho pélvico feminino na ressonância magnética. *Radiol Bras* 2001;34:323–326.
- Kim SH, Choi BI, Lee HP, et al. Uterine Cervical Carcinoma: Comparison of CT and MR findings. *Radiology* 1990;175:45–51.
- Meanwell CA. The epidemiology and etiology of cervical cancer. In: Blackledge GRP, Jordan JA, Shingleton HM, eds. *Textbook of gynecologic oncology*. Philadelphia: WB Saunders, 1991:250.
- Bosch FX, Castellsague X, Munoz N, et al. Male sexual behavior and human papillomavirus DNA: key risk factors for cervical cancer in Spain. *J Natl Cancer Inst* 1996; 88:1060.
- Bellomi M, Bonomo G, Landoni F, et al. Accuracy of CT & MRI in detection of lymph node involvement of cervical carcinoma. *EUR Radiol* 2005 Dec; 15[12]: 2469-74.
- Pannu HK, Corl FM, Fishman EK. CT evaluation of cervical cancer: spectrum of disease. *RadioGraphics* 2001;21:1155–1168.
- Manos MM, Kinney WK, Hurley LB, et al. Identifying women with cervical neoplasia: Using human papillomavirus DNA testing for equivocal Papanicolaou results [see comments]. *JAMA* 1999;281:1605.
- Walsh JW, Goplerud DR. Prospective comparison between Clinical and CT staging in Primary Cervical Carcinoma. *AJR* 137:997 1981.
- Togashi K, Nishimurak, Itoh K, et al. Uterine cervical cancer: assessment with high field MR imaging. *Radiology* 1986;160:432-435.
- Chiang SH, Quek ST. Carcinoma of the cervix: role of MR imaging. *Ann Acad Med Singapore* 2003;32:550–556.
- American Cancer Society. *Cancer facts and figures—1997*. Atlanta, GA: American Cancer Society, 1997.
- Misciasci T, Cozza G, Perrone L, et al. Diagnostic imaging in follow up of recurrent cervical carcinoma RAYS 2004 Apr-Jun 29(2):201-8.