ORIGINAL RESEARCH PAPER

Radiology

THE ROLE OF MAGNETIC RESONANCE IMAGING IN THE DIAGNOSIS OF RECURRENCE IN CARCINOMA OF CERVIX

KEY WORDS:

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ABSTRACT

BACK GROUND : Carcinoma cervix is one of the most common gynecological malignancies and a frequent cause of death . It's very common among females of 45-55 years of age in the developing countries.(1) . For cross sectional imaging of the carcinoma both MRI and CT used in the however MRI imaging is very useful of the excellent soft tissue resolution and imperative in the diagnosis of carcinoma of cervix .

TREATMENT : Surgery or radiotherapy are the treatment modalities available for early ca cervix where as late stage cancers are treated with radiotherapy which comprises of intra cavitary , Brachytherapy and external beam irradiation. It helps to deliver a high focused dose of radiation to a small region involving the cervix , parametrical tissues . Accurate information regarding the shape , size , volume mass, local spread , lymph node status which is very useful in identifying recurrence of carcinoma can be obtained from MRI (2)

MATERIALS AND METHODS : This study was conducted in the Department of Radiaodiagnosis , the Department of Radiation oncology and Department of Obstetrics and Gynecology in the Government Roypettah hospital , kilpauk medical college, Chennai . 80 Patients who are already diagnosed with carcinoma cervix and completed treatment with external beam irradiation and brachytherpy presenting with symptoms suspicious of recurrence of tumor were included in this study . In this study the parameters evaluated are recurrence of disease and post radiotherapy changes by combining the T2 WI , Dynamic contrast enhanced study and images in DWI / ADC sequences . Patients showing positive MRI findings for recurrence of carcinoma, biopsy was done and presence of recurrence was confirmed by histopathology evaluation

RESULTS : We analyzed parameters like location of disease, residual or recurrence of disease , post radiotherapy changes . MRI imaging with specific protocols including T2, DW weighted and dynamic T1 post contrast were adequate to confirm in diagnosis of carcinoma in previously treated patient with recurrence

INTRODUCTION :

Carcinoma cervix is one of the most common gynecologic malignancy is with an average patient age at onset of 45 years. MRI and CT are both used in the cross sectional imaging of the carcinoma however as excellent soft tissue resolution is imperative in the diagnosis of carcinoma of cervix ,this can be obtained from MRI. The International Federation of Gynecology and Obstetrics (FIGO) staging system is widely used for treatment planning (1) . This system is based on findings at clinical examination , chest radiography, intravenous urography, barium enema studies, cystoscopy, and proctoscopy. However lesion volume and nodal metastasis, two significant prognostic factors, are not assessed .Therefore, magnetic resonance (MR) imaging is now widely accepted . as optimal for evaluation of the main prognostic factors and selection of therapeutic strategy.

For treatment of early stage cancer surgery or radiotherapy are available and late stage cancers are treated with radiotherapy which is external beam irradiation or intra cavitary brachytherpy to deliver a high focused dose of radiation to a small region involving the cervix , parametrical tissues . MRI helps in predicting accurate information regarding the shape , size , volume , direction of the mass, local spread , lymph node status which is very useful in planning and executing radiotherapy . With increasing in the incidence of the number of the patients having recurrence of carcinoma in cervix post external beam irradiation and brachytherpy , early diagnosis of the recurrence is imperative in the treatment planning in such cases

MRI SEQUENCES :

All MRI studies were performed on a 1.5 Tesla body scanner unit (Siemens Magnetom Avanto) with a pelvic phased-array coil (Syner gy). Peristalsis was suppressed with 40 mg of N-butylscopolamine bromide. Superior and anterior saturation bands were used.

The pelvis was examined using axial tur bo spin-echo T1-weighted sequence (TR/TE, 1240 ms/9.1 ms; matrix size, 220×220; slice thickness, 3 mm; gap, 1.05 mm) and a set of spin-echo T2-weighted sequence (TR/TE, 5230 ms/96 ms; matrix size, 260×260; number of excitations, 2; slice thickness, 3 mm; gap, 1.05 mm) in the sagittal and axial planes. Diffusion weighted sequences (TR/TE, 4500ms/85 ms; matrix size, 250×250; number of excitations, 2; slice thickness, 3 mm; gap, 1.05 mm)

And Dynamic contrast enhanced MRI (TR/TE, 759 ms/11 ms; matrix size, 220×220; number of excitations, 2; slice thickness, 3 mm; gap, 1.05 mm) was also done

Fat-suppressed T1 3D gradient echo ac quisitions of the pelvis (frequency-selective suppression SPAIR—Spectral Attenuated Inversion Recovery) were obtained in the sagittal or axial plane (accordingly to the individual preferences of the performing radiologist) after a bolus injection of gadoiamide(omniscan) 0.5mmol/ml concentration at a dose of 0.1 mmol/kg of body weight followed by a rapid infusion of normal sa line solution (10 mL). Injection started after the first acquisition, and scanning was con ducted at 30, 60, 90, 120, and 150 s after the injection. We also obtained a late (taken at 5 min) T1W spectral presaturation inversion recovery (SPIR) sequence in the axial plane.

DWI was performed for both the abdo men and pelvis using single-shot echo-pla nar imaging and the array spatial sensitivity encoding technique (SENSE sequences (TR/TE, 4500ms/85 ms; matrix size, 250×250; number of excitations, 2; slice thickness, 3 mm; gap, 1.05 mm)in the axial plane with a b-value of 0, 600, and 1000 s/mm2. The image software automatically generated ADC maps.

Two radiologists (with 8 and 20 years of experience in interpreting pelvic MRI) per-formed a consensus interpretation of all images to determine whether lesions were recognizable on T2W and DCE

imaging, and also on DWI (with b=1000).

Three separate sets of images were ana lyzed: T2W and DWI sequences (T2W/DWI) and DCE .

DWI sequences were not evaluated alone because of the lack of anatomical referenc es. In the combined sets of sequences, DCE and DWI sequences were synchronized with T2W images for better lesion localiza tion and the avoidance of pitfalls.

DWI (with b=1000) was analyzed qual itatively according to the signal intensity of uterine cervical cancer, as determined by visually comparing the signal intensity with the myometrium signal. ADC maps were also analyzed qualitatively.

For DCE MRI, all acquisitions were an alyzed together, and the early enhance ments (30–90 s) of any abnormal structure, as well as isolated enhancing areas, were registered. Each observer individually re corded the presence and location of lesions in each set of images (T2W, DCE, and DWI), assigning as recur rent disease" (in patients exhibiting lesions with a high signal intensity on T2W imaging compared with muscle, early contrast up take on DCE sequence, or bright and dark areas on DWI and ADC maps);

MATERIALS AND METHODS :

Ours is a prospective study conducted in the department of Radio diagnosis, Department of obstetrics and gynecology in Government Royapettah hospital Chennai during for two years , about 80 patients previously treated with radiotherapy and presenting with clinical symptoms suggesting recurrence were included in the study . We obtained detailed clinical history ,presence of co existing diseases , treatment and surgical history , allergy to medications were documents . Patients with known allergy to drugs, patients with known contraindication to undergo MRI imaging were excluded from the study . Procedure was clearly explained to patients who were willing to undergo the imaging . MRI imaging was done with (Siemens Magnetom Avanto) MRI along with sequences specific sequences for our study – T2 weighted sequence in sagittal and axial plane , DWI sequence in axial plane , T1 dynamic contrast phase after injecting gadolinium contrast were done in axial and sagittal plane was done. The images were studied by two experienced senior faculty in the Department of Radio diagnosis. Histopathological examination was done for all the patients for detecting the presence of Histopathological evidence of recurrence and it was documented.

RESULTS:

Out of 80 patients investigated with MRI imaging , 76 cases showed evidence of recurrence of disease. The most common site of recurrence was in the posterior wall of cervix. Protocol using T2W/DWI images showed evidence of tumour in 74 cases using the criteria of hyperintensity of the recurrence of lesion and restriction of diffusion . Two cases which showed no hyper intensity or restricted diffusion were picked up with dynamic contrast enhancement. Combining the findings of T2WI , diffusion and dynamic contrast in study 76 patients were diagnosed with recurrence of disease were subjected to Histopathological examination.

Out of 76 cases presence of recurrence was confirmed Histopathologically in 73 cases where as 3 cases showed no evidence of malignancy.

DISCUSSION :

In our study combination of DWI, T2,DCE MR has diagnosed 73 patients with a false positive result of 3 cases. Imaging for examination of tumor recurrence in MRI is difficult due to changes like post radiation inflammation and fibrosis, however imaging with specific protocols like T2 WI ,DCE, DWI sequences increases the sensitivity in diagnosing the recurrence. T2 WI shows presence of recurrent tumour as a high signal intensity focus in comparison to the post radiation fibrosis which shows hypo intensity in T2 sequences. DWI shows excellent tissue contrast with ADC values which helps in qualitative assessment of restriction of diffusion provides excellent diagnostic capabilities to patients who have contraindication to gadolinium based contrast injection like renal failure patients. Dynamic contrast enhanced MRI performed with injection of gadolinium based contrast shows early arterial phase contrast enhancement based on neovascularaisation of tumor.

The findings in our study are concurring with the work of Hricak et al (3) who found post radiation desmoplasia shows very low signal in T2WI . Sala E et al (4) showed that Dynamic contrast study combined along with T2 WI and DWI was able to significantly increase diagnostic capability in post radiotherapy recurrence. Similar findings were observed by Salani R et al (5)and Kinker et al (6)

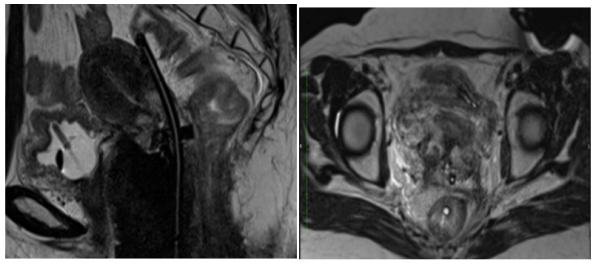
Post Radiotherapy changes and complications :

Ovaries shows reduction in volume and there is loss of follicular activity at doses greater than 20 Gy, which results in permanent sterility and substantial ovarian dysfunction. Endometrium thinning loss of myometrial zonal anatomy and reduction in uterine volume. Affected bowel loops show increased signal intensity caused by edema with mural thickening. Urinary Bladder shows thick walled edematous bladder with mucosal bulbous edema. Bone marrow shows fatty marrow replacement and perirectal and presacral spaces shows increased signal intensity.

CONCLUSION :

MRI imaging with its soft tissue resolution is a very useful imaging modality in the diagnosis , pre treatment evaluation . Special tailored protocol with T2 weighted, Diffusion weighted and dynamic contrast enhanced sequences are very useful in diagnosing recurrence in post treated patients

Images 1:



1.

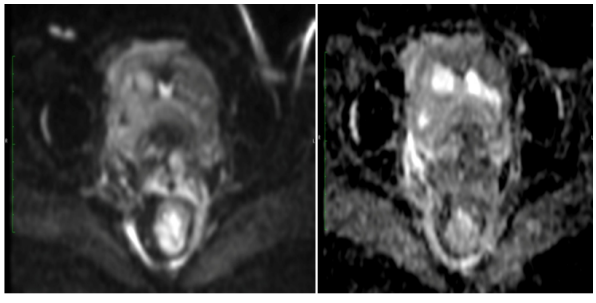
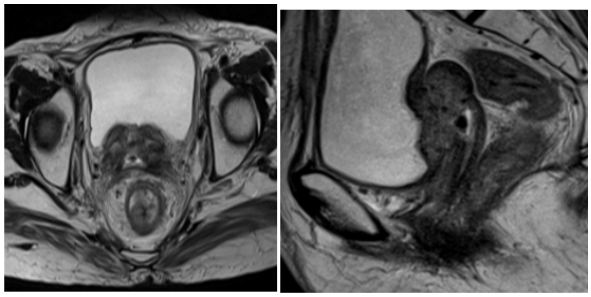


Figure 1 : Hyperintense lesion in the cervix, also extending into the upper 1/3 rd of vagina in T2WI showing restricted diffusion in corresponding DWI and ADC images.

Images 2.



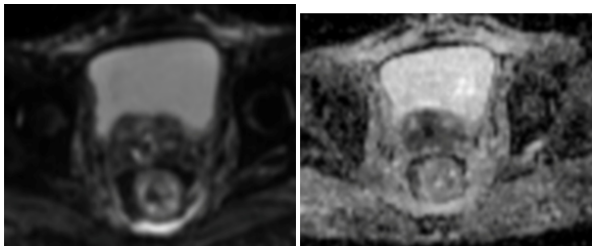


Figure 2: Hyperintense lesion in the cervix, also extending into the lower uterus and infiltration of posterior urinary bladder wall in T2WI showing restricted diffusion in corresponding DWI and ADC images.

Images 3

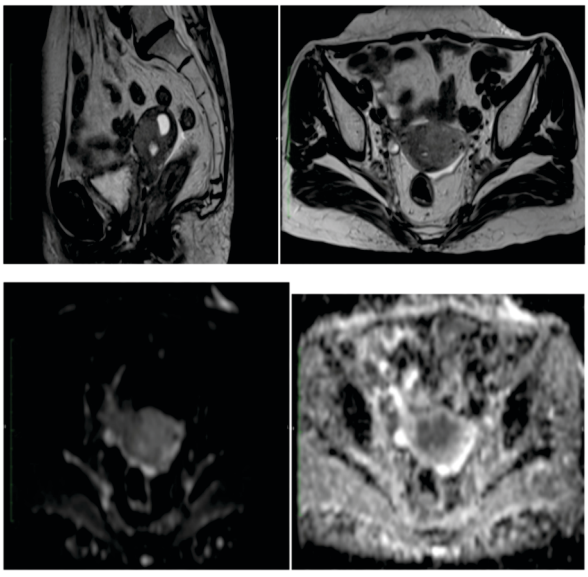


Figure 3: Hyperintense lesion in left lateral aspect and anterior fornix of cervix showing restricted diffusion and T2 hyperintensity with infiltration of posterior urinary bladder wall, extending into lower uterus and upper 1/3 rd of vagina.

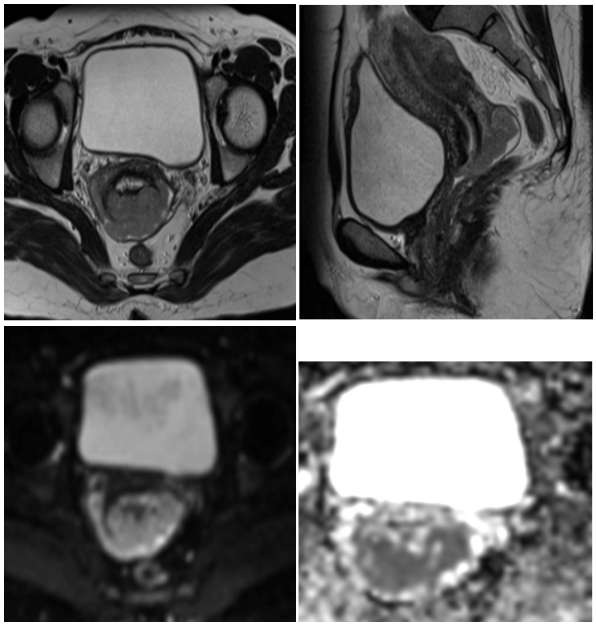


Figure 4: Hyperintense lesion in the cervix, with serosal infiltration of posterior urinary bladder wall in T2WI showing restricted diffusion in corresponding DWI and ADC images.

Images 5

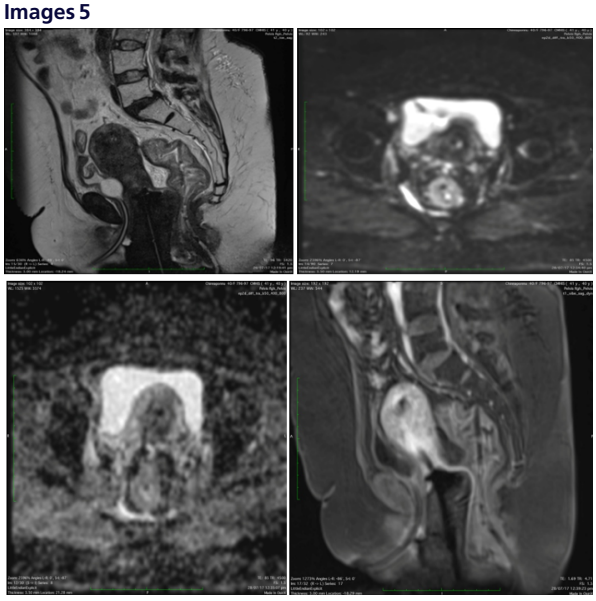


Figure 5. Showing hyperintense lesion in T2 WI showing restricted diffusion in DWI and corresponding ADC sequence with strong contrast enhancement in the dynamic contrast enhanced study

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