Role of 64 Slice MDCT with Addition of Single T2W Sequence on 1.5 Tesla MRI in Local staging of Rectal Carcinoma

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ABSTRACT

Introduction: The local staging of rectal cancer is crucial for prognosis and treatment planning. It aims at determining the exact extent of the tumour and helps the clinician in deciding whether surgery alone or surgery in combination with neo-adjuvant chemotherapy should be offered to the patient. The study was done to compare the accuracy of 64 slice MDCT with 1.5T T2W sequence in local staging of biopsy proven cases of rectal carcinoma, to assess the agreement between MDCT and MRI in local staging with histopathological staging and to assess the agreement between the imaging modalities (MDCT and MRI) in local staging of rectal cancer in all patients.

Material and methods: This prospective study was conducted from November 2012 to August 2014 wherein 41 biopsy proven cases of rectal carcinoma were evaluated with Dual phase MDCT and T2W MRI. The local staging was performed and correlated with histopathology which was taken as the gold standard.

Results: The overall accuracy of MRI (89 %) was marginally better than MDCT (83 %) in detecting the invasion of the tumour however no comparable difference in the accuracy was found in detection of metastatic perirectal nodes (50%).

As compared to histopathology, kappa value for T staging on MDCT was 0.7 (substantial agreement) and was 0.8 (good agreement) for MRI. While the kappa value for N staging on MDCT is 0.3, indicating a fair agreement between MRI and MDCT and histopathological nodal staging. There was a good agreement between the imaging modalities in local staging (K=0.75) with respect to Tumour staging and a very good agreement in local nodal staging (K=0.88).

Conclusion: The accuracy of MRI is marginally better than MDCT in detecting invasion of the tumour with no comparable difference in detection of perirectal metastatic lymph nodes. The agreement of MRI with histopathology was better for tumour staging, with both modalities demonstrating a fair agreement for nodal staging. The agreement between the imaging modalities was substantial for tumour staging and very good for nodal staging.

Keywords: Rectal, carcinoma, cancer, local staging, MDCT, MRI.

INTRODUCTION

Colorectal cancer is third most common cancer and is responsible for significant mortality and morbidity.[1] The incidence in Asian population is 4.3 per one lakh population. The prognosis of rectal cancer depends upon the extramural tumour spread into mesorectum[2,3], ability to achieve surgical clearance[4,5], and presence of occult hepatic and lymph nodal metastases.

The local staging of rectal cancer is crucial to determine the tumour extent, prognostication and treatment planning. Cross sectional imaging modalities like Dual phase MDCT allows examination in different vascular phases to optimally detect target lesions.[6] With the advent of powerful gradient coil systems and high resolution surface coils, Magnetic resonance imaging (MRI) is playing an important role in local staging of rectal cancer. It is highly accurate in predicting whether tumour free margin can be achieved and thus provides important information for treatment planning, especially in patients with advanced rectal cancer.[7]

Objectives of the research were to compare the accuracy of 64 slice MDCT with 1.5T T2W sequence in local staging of biopsy proven cases of rectal carcinoma, to assess the agreement between MDCT and MRI in local staging with histopathological staging and to assess the agreement between the imaging modalities (MDCT and MRI) in local staging of rectal cancer in all patients.

MATERIAL AND METHODS

This prospective study was conducted in Department of Radiodiagnosis and Imaging of Kasturba Hospital from November 2012 to August 2014, using GE Signa HDxt 1.5 T MRI and 64 slice Phillips MDCT scanner. The total number of cases included in this study was 41. The study was conducted in accordance with the guidelines of Institutional Ethical Committee and informed consent was obtained.

All the biopsy proven cases of rectal carcinoma, which were referred for MDCT staging workup for rectal carcinoma were included and further limited MRI (T2W sequence) was performed.

CT Technique: Dual phase MDCT of the abdomen and pelvis was performed, after 45 minutes of oral mannitol administration and insufflation of rectal air just before the scan. The scans were performed after IV injection of 80 ml of iohexol with slice thickness of 5 mm, reconstruction interval of 1.5mm, matrix 512 x512, 120 Kvp, 250 ma and pitch of 1.1.

MR Technique: Subsequently, patients underwent MRI of pelvis using a phase array coil. T2 weighted Fast Spin Echo sequence was done using a FOV of 25, TR 80, TE 4500, Slice thickness 3mm and NEX of 4. Initially sagittal images were acquired and further true axial images were planned

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perpendicular to the rectal wall at the level of the tumor and coronal images were planned perpendicular to axial images. TNM staging was used to stage the cancer, where T1 and T2 tumours were confined to the mucosa. T3 were tumors invading the muscularis propria and confined to it and those infiltrating the adjacent organs were considered as stageT4. Size criteria of 5mm was taken into consideration for local nodal staging. Absence of perirectal nodes was given stage of N0, presence of 1-3 nodes of more than 5 mm was N1 and more than 4 nodes was considered as N2.

The MDCT and MRI sections were reviewed on workstation and local T and N staging was performed separately for MDCT and MRI. Histopathological staging obtained after surgery, was taken as the gold standard. Cohen's Kappa test was used for measuring the agreement between imaging modalities and histopathology.

RESULTS

Out of the 41 patients 18 cases underwent surgery and histopathological T and N staging was available. The remaining 23 cases were referred for NACT, and palliative therapy and thus histopathological staging was unavailable.

Out of these 18 cases, histopathological analysis showed T2 stage in 9 cases (50 %), T3 in 8 cases (44 %), and T4 in one case (6 %). Local nodes showed stage No in 9 cases (50 %), stage N1 in 5 cases (28 %) and stage N2 in 4 cases (22 %). The accuracy of MRI (88.8 %) on local staging was marginally better as compared to MDCT (83.3%) in local Tumour staging, with both modalities being equally accurate in detecting the metastatic local lymphadenopathy (50%).

T staging

As compared to histopathology, kappa value for T staging on MDCT was 0.7 (substantial agreement) and was 0.8 (good agreement) for MRI. There was a good agreement between MRI and MDCT in local staging (K=0.75) with respect to Tumour staging. The sensitivity, specificity and accuracy of MDCT and MRI in local Tumour staging is as depicted in Table 1.

N staging

The kappa value for N staging on MRI and MDCT is 0.3, indicating a fair agreement between MRI and MDCT and histopathological nodal staging. There was a very good agreement between MRI and MDCT in local nodal staging (K=0.88). The sensitivity, specificity and accuracy of MDCT and MRI in local Nodal staging is as depicted in Table 2.

DISCUSSION

Although rectal cancers can be diagnosed using various modalities such as per rectal examination, barium enema,

Local	T stage	Sensitivity (%)	Specificity (%)	Accuracy(%)
MDCT	T1-2 stage	77.8	100	88.8
MRI	T1-2 stage	77.8	100	88.8
MDCT	T3 stage	87.5	80	83.3
MRI	T3 stage	100	80	88.8
MDCT	T4 stage	100	94.1	94.4
MRI	T4 stage	100	94.4	100

Table-1: The sensitivity, specificity and accuracy of MDCT and MRI in local Tumour staging.

Local	N stage	Sensitivity (%)	Specificity(%)	Accuracy(%)
MDCT	No stage	11.1	100	55.5
MRI	No stage	11.1	100	55.5
MDCT	N1 stage	80	92.3	88.8
MRI	N1 stage	80	100	94.4
MDCT	N2 stage	100	43	55.5
MRI	N2 stage	100	43	50

Table-2: Sensitivity, Specificity and Accuracy of MDCT and MRI in local Nodal staging.

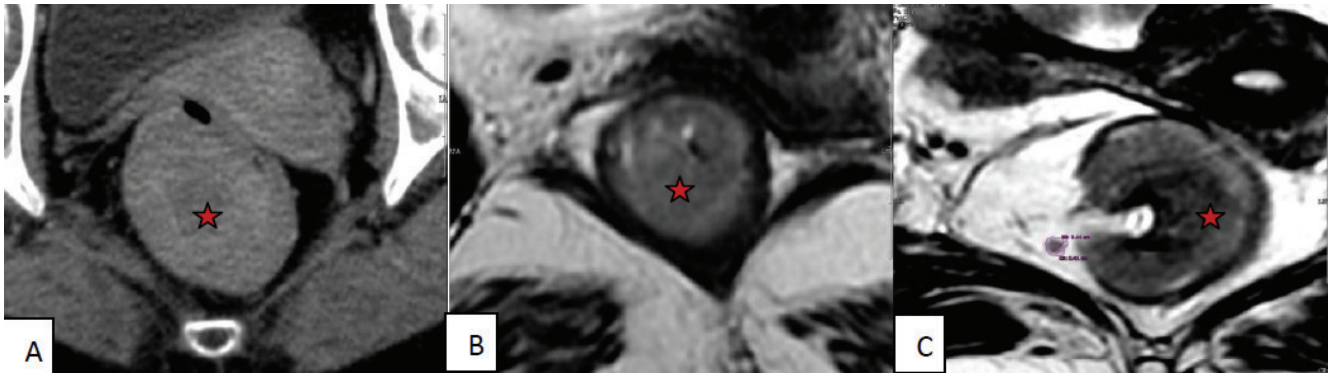

Figure-1: MDCT axial image (A) shows heterogeneously enhancing polypoidal growth (star) in rectum causing luminal compromise. T2 weighted MRI axial images (B, C) show hyperintense polypoidal growth (star) in the rectum infiltrating the muscularis layer, not extending into the mesorectal fat. Single perirectal node (curvilinear line) was identified, which was smaller than 5mm, hence the tumour was staged T2 N0 which corresponded with histopathological staging.

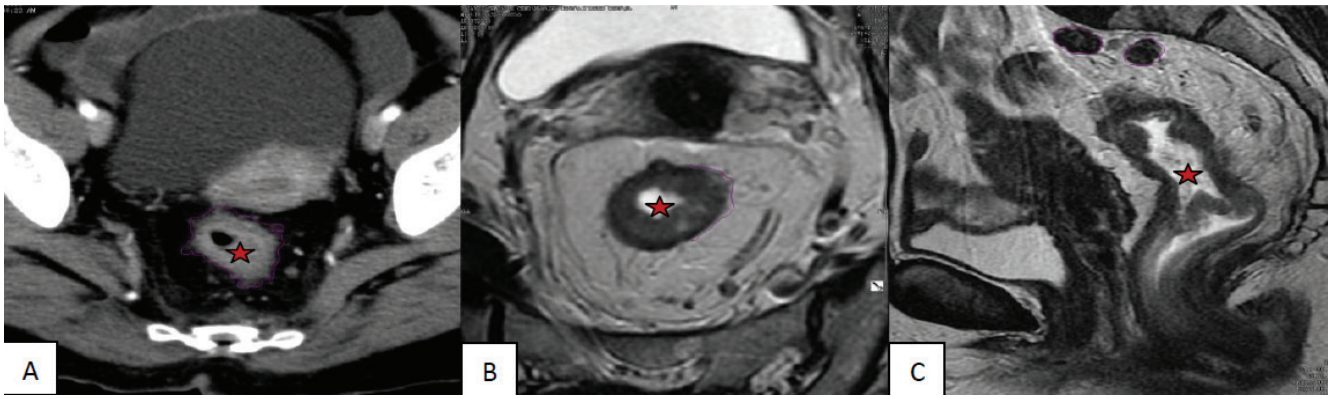

Figure-2: MDCT sagittal and axial image (A) shows heterogeneously enhancing high rectal wall thickening (star) with extension of the tumour into the mesorectal fat (curvilinear line). MRI T2 weighted axial and sagittal images (B, C) show rectal wall thickening with extension of the growth into the mesorectal fat (curvilinear line) and two enlarged perirectal nodes (arrow head). The tumour was staged T3 N1 which was proved on histopathology.

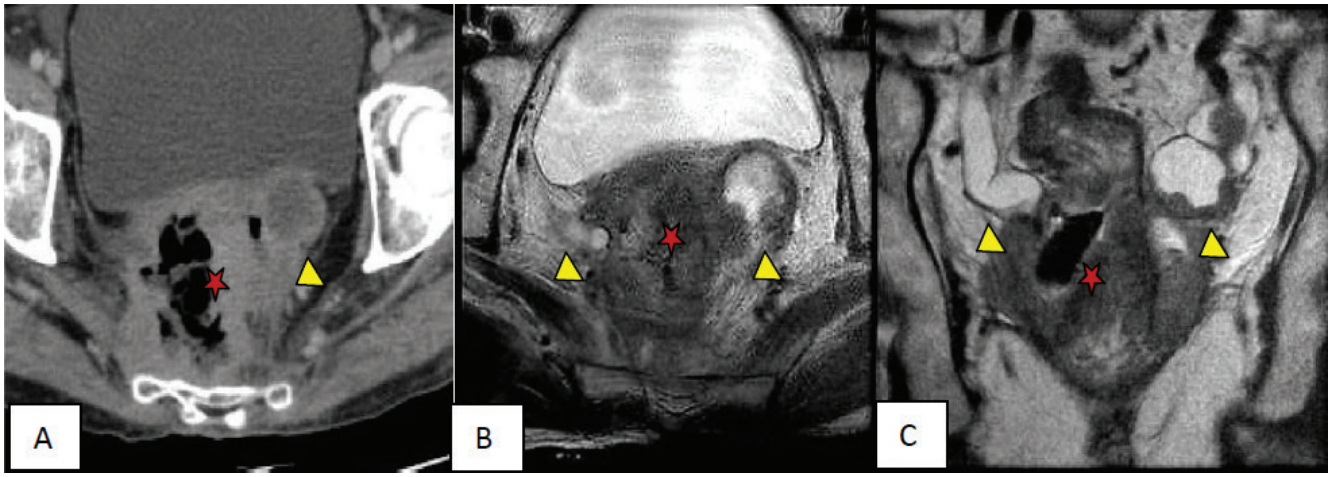

Figure-3: Sagittal and axial MDCT (A) image show heterogeneously enhancing low rectal wall thickening (star) infiltrating the ureters (arrow head). T2 weighted MRI axial and coronal images (B,C) show extensive locally advanced low rectal growth (star) infiltrating the mesorectal fat with encasement and infiltration of ureters (arrow head) on either sides. The tumour was given a stage of T4 N0.The patient subsequently underwent a palliative surgery and bilateral DJ stenting.

colonoscopy or sigmoidoscopy, these do not provide sufficient information about the extraluminal spread of the tumor. Cross sectional imaging modalities such as Endoscopic Ultrasound, MDCT and MRI, help in detecting tumour infiltration into various layers of bowel wall and beyond it.

The accuracy of MDCT in Tumour staging is comparable to previous studies[8-10] due to similar parameters of image acquisition. The accuracy in detection of T4 lesions was better in present study when compared with previous studies[10,11] perhaps due to the fact that the lesions demonstrated a gross infiltration which could be easily identified.

The study by Kim CK et al.[8] demonstrated similar sensitivity and specificity of MDCT in detecting the T1/2 and T3 lesions. In present study, sensitivity, specificity and accuracy of MRI in T2 and T3 tumours were 77.8 %, 100% and 88.8% and 100 %, 80 % and 88.8% respectively which correlate well with previous studies.[8,12]

With respect to agreement of imaging modalities with histopathology, MDCT showed substantial agreement for tumour staging. Agreement of MRI tumour staging with histopathology was similar to study by Aysun Uçar et al.[13], due to similar parameters of image acquisition and evaluation.

We found a good agreement between both the imaging modalities (MDCT and MRI) in local Tumour staging.

The accuracy of MDCT in detecting the nodal status was 50 %, which is in concordance with the data published by Matsuoka H et al[12] with both studies assuming size criteria for diagnosing positive nodes. Present study showed a low 50 % accuracy rates in local nodal staging by MRI which is poor as compared to the previous published data[12,14] as most of the nodes detected in the study were reactive on histopathology, with increased false positive rate.

There was a fair agreement between histopathology and both modalities for nodal staging. While a very good agreement was found in between MDCT and MRI in local nodal staging.

The major limitation of present study was small sample size as most of the cancers were discovered in advanced stage with loco regional spread and distant metastases and were treated with chemotherapy-radiotherapy. The reason for absence of T1 stage tumour in our study can be explained by the fact that these early cancers are asymptomatic and cannot be detected unless a regular screening is performed.

CONCLUSION

Accuracy of MRI (89 %) is marginally better than MDCT (83 %) in detecting invasion of the tumour (T staging). No

comparable difference in the accuracy was found between MDCT and MRI in detection of metastatic perirectal nodes due to inability to distinguish between metastatic and reactive nodes. The agreement of MRI with histopathology was better for tumor staging as compared to MDCT, with both modalities demonstrating a fair agreement for nodal staging. The agreement of MDCT with MRI was substantial for tumor staging and very good for nodal staging.

ABBREVIATIONS

MDCT- Multi Detector Computed Tomography, T2 W- T2 weighted Imaging, MRI- Magnetic Resonance Imaging, T stage - Tumour Staging, N stage – Nodal Staging, IV- Intra Venous, KVp- KiloVoltage potential, Mas- Milli ampere second FOV- Field Of View, TR- Relaxation Time, TE- Time to Echo, NEX- Number Of Excitations

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