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Comparative efficacy of preoperative staging of local rectal carcinoma by Transrectal Ultrasound and MRI of histopathological confirmed cases at Tertiary care Hospital

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Abstract

Colorectal cancer is the third most common cancer worldwide. Approximately 147,000 patients arediagnosed with colorectal cancer each year, and 57,000 deaths are attributed to this disease. The prognosis of patients with colorectal cancer is related to the stage of disease at diagnosis and tumour histology, including differentiation,lymphatic invasion, and extent of tumour-free surgical resection margins. In the present study we look at the two radiological investigative modalities that are routinely used for the local staging i.e.Magnetic resonance imaging (MRI) and Transrectal Ultrasound (TRUS) and try to identify which of two investigative modalities is the best in local staging of carcinoma of rectum. **Material and methods:**20 patients(11Males and 9 females) with Carcinoma rectum seen from July 2008 to Dec 2010 in outpatient or ward were screened prospectively. After obtaining detailed history, clinical examination was done.The efficacy of Transrectal ultrasound, and Magnetic resonance imaging in preoperative local staging of rectal cancer was compared with histopathological confirmation. **Results:** In MRI they were represented as three concentric layers (high: interface with submucosa; low: the proper muscle; high: perirectal fat). In TRUS scan all the layers of the wall of the rectum were well made out.The tumor detection rate was 100% (20 of 20) in TRUS and MRI scan.**Conclusion:**Patients with carcinoma rectum need to be preoperatively staged with a certain degree of accuracy because their treatment depends on the preoperative image based staging. It helps in deciding if surgery or neoadjuvant treatment followed by surgery is the best treatment for that patient, also helps in prognostication of the patient.
Keywords: Rectal carcinoma, transrectal Ultrasound, preoperative staging.

Introduction

Colorectal cancer is the third most common cancer worldwide. Approximately 147,000 patients are diagnosed with colorectal cancer each year, and 57,000 deaths are attributed to this disease[1].The probability of colorectal cancer developing during a lifetime is approximately 6%.In recent years, Mortality rates have decreased due to major changes in therapeutic management, in particular the standardization of the operative procedure and the introduction of adjuvant and Neoadjuvant therapy. Colon cancer is three times more common than rectal cancer. There are at least two well-described genetic pathways leading to the development of colorectal adenocarcinoma- the chromosomal instability (CIN) pathway and the microsatellite instability (MIN) pathway. Colorectal cancer primarily develops from adenomatous polyps over a period of 10–15 years, known as the adenoma-carcinoma sequence[2].The prognosis for patients with colorectal cancer is related to the stage of disease at diagnosis and tumour histology, including differentiation, lymphatic invasion, and extent of tumour-free surgical resection margins. Molecular genetic markers may, in the future, define subsets of patients either more or less likely to develop tumour recurrence and so lead to more rational application of adjuvant multimodality

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treatment[3,4].Critical in the treatment of colorectal cancer is the understanding that the role of surgery for the primary tumour is limited to those patients for whom cure is realistically possible or to those patients with symptomatic lesions resulting in acute obstruction or clinically significant bleeding. For patients who present with synchronous primary and incurable metastatic disease, resection of the primary is not routinely indicated. Advances in systemic chemotherapy have greatly increased the likelihood of tumour control via medical management, and chemotherapy can be routinely started with an asymptomatic or minimally symptomatic primary in place. There is no need to "prepare such a patient for chemotherapy" by performing palliative resection of a primary that does not actively require palliation. In fact, resection of the primary lesion in the setting of metastatic disease has a significant associated morbidity and mortality[5].Hence it is very important to make a good preoperative staging of the disease to select patients who are candidates for surgical treatment. In this study we look at the two radiological investigative modalities that are routinely used for the local staging i.e. Computed To, Magnetic resonance imaging (MRI) and Transrectal Ultrasound (TRUS) and try to identify which of these three investigative modalities is the best in local staging of carcinoma rectum.

Material and methods

A total of 20 patients of age between 30-79 years with histopathologically proven rectal cancer between July 2008 and December 2010 were included in the study.Ethical clearance was obtained by Institutional ethical committee. All patients underwent Transrectal Ultrasound scan and MRI. Eight patients were assessed

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but excluded from the study because 5 of them had obstructing growth and hence TRUS was not possible to be performed, three of the patients were excluded because they were found to have unresectable disease at surgery and hence specimen was not available for histopathological examination. All patients underwent surgery, and histological staging was performed according to the TNM classification of AJCC 6th edition. Five patients underwent Abdominoperineal resection and fifteen patients underwent Low anterior resection .The TRUS apparatus was composed of a radial scanner, an imaging unit SSD-520, and an ultrasound probe ASU-59 (Aloka Co. Ltd., Tokyo, Japan). The endorectal probe conducted 360 ~ scans transversely in reference to the longitudinal axis of the rectum. The transducer emitting a 7.5-MHz beam was attached on the end of a rod measuring 65 cm in length and 10.4 mm in diameter. Ultrasound staging was performed according to Hildebrandt and Feifel: uT1, the tumor is confined to the mucosa and submucosa; uT2, the tumor is confined to the rectal wall; uT3, the tumor penetrates through the rectal wall and its perirectal fat; uT4, the tumor invades surrounding organs. Lymph node involvement was considered present if nodes equal to or greater than 5 mm in diameter were found in the perirectal area adjacent to the tumor. Depth of tumour involvement (T stage) and lymph Nodal status (N stage) was assessed using AJCC 6th edition. The Transrectal ultrasound was done by a single radiologist who special interest in Transrectal ultrasound.
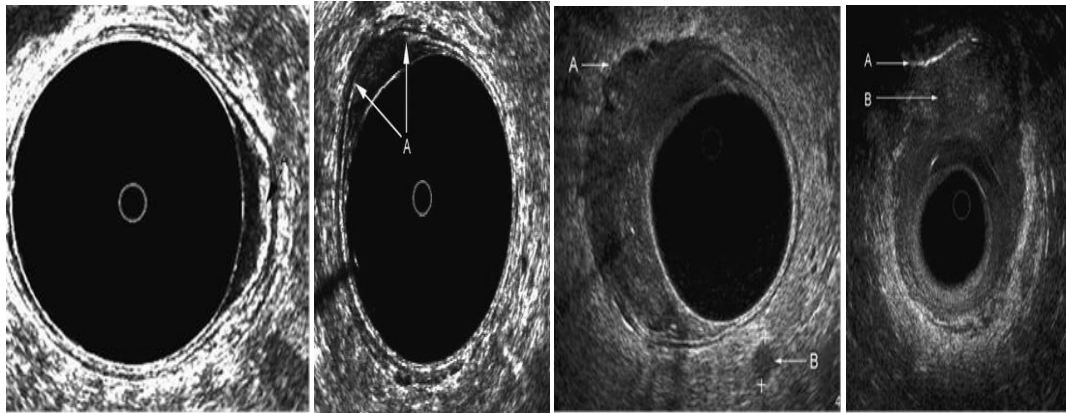

Fig 1: Staging Modalities by Trans Rectal Ultrasound (TRUS)[T1 Tumour,T2Tumour,T3 Tumour,T4 Tumour]
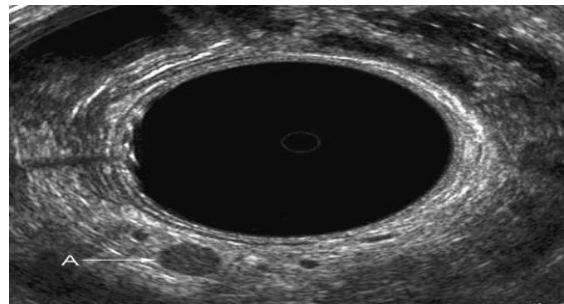

Fig 2 : TRUS showing Metastatic lymph node

MRI scan of the pelvis was done for all patients using SEIMENS AVANTO 1.5Tesla MRI machine. Depth of tumour involvement (T stage) and lymph nodal status (N stage) was assessed using AJCC 6th edition. MRI sequences were obtained by T1-weighted image (TR 11 ms, TE 550 ms), T2-weighted image (TR 3000 ms, TE 100 ms), and T2 fat-saturated image (TR 3500 ms, TE 100 ms). The matrix size was 256 x 192 for T1-weighted images and 256 x 256 for T2-weighted images. Slice thickness was 5 mm, and interslice gap was 3 mm in all axial, sagittal, and coronal slices. Lymph node involvement was considered present if nodes equal to or greater than 5 mm in diameter were found in the perirectal area adjacent to the tumor. All the cases were reported by a single radiologist with special interest in MRI. These three examinations were performed on the same or different days owing to our examination schedules, but

The interval did not exceed more than a week. The radiologists doing the TRUS, and MRI were blinded and did not know each other's report

Inclusion criteria
1. Patients with rectal cancer who underwent TRUS, and MRI, followed by surgery and Histopathological examination of resected specimen
2. Patients investigated and operated in the study period

Exclusion criteria
1. Patients who do not undergo Trans rectal ultrasound and MRI
2. Patients who are not operated
3. Patients who do not undergo definitive surgery
4. Patients with obstructed growth

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Results

The patients who underwent surgical resection of the cancer with histopathological examination of the resected specimen (20 patients) were included into the study. Resected specimens were examined by pathologists without knowing the preoperative TRUS, and MRI findings. the histopathological staging was done using AJCC 6th edition.The diagnostic accuracy of TRUS and MRI for tumor invasion and lymph node metastasis was assessed using the histopathological findings as the gold standard. All patients tolerated TRUS and MRI examinations without any complications. In MRI they were represented as three concentric layers (high: interface with submucosa; low: the proper muscle; high: perirectal fat) in MRI. In TRUS scan all the layers of the wall of the rectum were well made out.

Table 1:Showing accuracy of investigations in assessing T statusby TRUS and MRI

Investigation	T1 N=1 (%)	T2 N=4 (%)	T3 N=12 (%)	T4 N=3 (%)
TRUS	1(100)	2(50)	11 (91.75)	1 (33.3)
MRI	(0)	2(50)	9 (75)	1 (33.3)

Table 2: Accuracy of investigations in assessing N status

Investigation	N0 N=9 (%)	N1 N=3 (%)	N2 N= 8 (%)
TRUS	6 (66.6)	2(66.6)	6 (75)
MRI	5 (55.6)	2(66.6)	5 (62.5)

Table 3: Accuracy of Investigations in preoperative staging

Investigation	stage I N=5 (%)	Stage II N=4 (%)	Stage III N=11 (%)
TRUS	2 (40)	2 (50)	11 (100)
MRI	5 (60)	0 (0)	11 (100)

Discussion

Preoperative evaluation of advanced rectal carcinoma is of importance to determine optimal surgical and adjuvant treatment. The stage at diagnosis often determines survival for individuals with Rectal Cancer. During past decades staging of rectal cancer was determined mainly with digital rectal examination and radiography, later on with computed tomography (CT) and magnetic resonance imaging (MRI). In recent years, TRUS is becoming the leading diagnostic procedure for cancer of anus and rectum. The role of MRI in staging rectal cancer is not universally agreed upon, but the ability of MRI to estimate tumor invasion of the mesorectal fascia is widely accepted.Each study has its limitations. MRI is not available at all institutions and cannot be performed in patients with certain metal medial prostheses. Endorectal coil MRI has better results but is not available in all centers and is also cumbersome to perform. TRUS is cheap and is readily available in all centers but cannot be performed in patients with stenosing rectal lesions. As the rectum is located in the pelvis adjacent to the genitourinary and reproductive organs, preoperative evaluation of extra rectal spread should always be evaluated preoperatively. Although there is a good correlation between digital rectal examination by an experienced surgeon and the pathologic examination, most surgeons prefer objective support for their subjective impression and to look for perirectal lymphadenopathy. Magnetic resonance imaging has been valuable in the clinical setting in this regard. Even with improved imaging resolution of MDCT, it is still difficult to discriminate rectal wall layers as conventional single detector helical CT scan, whereas MRI can discriminate rectal wall into three or five concentric layers depending on the coil used [6,7]. Transrectal ultrasound can delineate all the layers of the rectum and is also a good investigation for local assessment of the depth of involvement of the wall of the rectum. Satoh et al[8]. reported that the accuracy rate of TRUS vs. MRI has been compared and results showed TRUS was superior to MRI and CT for assessing depth of wall invasion and nodal involvement. But, Kim et al[9] reported that TRUS and pelvic MRI show a comparably high accuracy rate for determining depth of rectal wall invasion and adjacent organ invasion. In our study we found that the overall accuracy of MRI was 39.575% for the detection of T status across all the groups as compared to literature of 59-88%[10], as compared to literature of about 73% , whereas the overall accuracy to detect the T status across all T groups was 68.7% as compared to about 69- 95% in literature[10]. TRUS overstaged the T stage in 20% of patients and understaged in 5% patients, as compared to 18% overstaged[11] and 13% understaged in literature which is comparable to overstaging and better when it came to understaging the T status. Overstaging most commonly occurs with T2 lesions that appear as T3 lesion. Understaging can be caused by microscopic infiltration, which is not detectable by the resolution obtained by the current ultrasonography instruments.In our study TRUS was found to be best modality for T1 stage disease however only one of the twenty patients was in the T1 group, this is a very small no to comment on the accuracy. For T2 disease both TRUS and MRI had an accuracy of 50% and for disease confined to the colon i.e. T2 disease in our study TRUS and MRI had equal efficacy. For T3 lesions the accuracy of all three investigations was better. TRUS had a accuracy of 91.75%, MRI an accuracy of 75%. For T3 lesions the accuracy of all the three investigations was good. The accuracy for T4 disease was only about 33.3% for TRUS and MRI. It is found in our study that Transrectal ultrasound is a very good modality to delineate the various T stages of the carcinoma rectum and has better accuracy as compared to MRI. Early disease was better picked up by TRUS compared to MRI but because of the small sample size it is difficult to attribute importance to this finding.For disease confined to the bowel wall TRUS had better efficacy compared to the MRI which either understaged or over staged the T status.In T4 disease all the three investigations were equally poor in predicting preoperatively, this is contrary to literature. In nodal status evaluation, TRUS was slightly better than MRI scan in Node negative patients (N0) with TRUS having accuracy of 66%, MRI having accuracy of 55%. This is because of overstaging of lymph node status as 0.5 cm was taken as cutoff for detection preoperatively and many lymphnodes which are above 0.5cm and less than 1cm being negative for metastasis. Differentiation of inflammatory nodes from metastatic nodes is difficult in TRUS, MRI scan. The application of size criteria to assess the status of perirectal lymphadenopathy would improve specificity but reduce sensitivity. Node size is a bad indicator of metastatic disease, because many small lymph nodes (<5 mm) can contain metastases. Although it has been suggested that hyperechoic lymph nodes correspond to inflammatory nodes and hypoechoic lymph nodes are metastases, the interpretation of echographic findings is strongly related to the experience of the investigatorFor node positive disease also TRUS had superior accuracy compared to MRI scan. The overall accuracy for nodal status prediction preoperatively was 69.4% with TRUS, 61.56% for MRI scan. This is comparable to the literature with accuracy of about 70-83% for

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Transrectal ultrasound[12], 63% for MRI. The stage prediction among stage I patients was similar in TRUS was 40% whereas it was slightly better with MRI at 60% accuracy. The TRUS had prediction accuracy of 50% for stage II patients; MRI however did not stage these patients properly. All the three investigations had very good accuracy for predicting the Stage III patients with TRUS and MRI correcting identifying all stage III patients (100%). This shows that both the investigations were less accurate to predict earlier stage disease, whereas all three could accurately predict patients with stage III disease.The overall accuracy for preoperatively prediction of the stage of the disease was for TRUS, and 53.3% for MRI. Hence in our study TRUS had a better overall accuracy for prediction of stage of patients as compared to MRI scan.The advantage of this study being that every patient underwent both diagnostic tests and the radiologists performing the tests were blinded to each other's reports

Conclusion

Patients with carcinoma rectum need to be preoperatively staged with a certain degree of accuracy because their treatment depends on the preoperative imagebased staging. It helps in deciding if surgery or neoadjuvant treatment followed by surgery is the best treatment for that patient, also helps in prognostication of the patient.TRUS is a cost effective and readily available investigation and has been shown in literature and in our study as a reliable and accurate test for local staging of patients with carcinoma rectum. TRUS should be included as an integral part of preoperative imaging of patients with carcinoma rectum. In the presence of a radiologist with experience in TRUS may be sufficient to stage patients with carcinoma rectum preoperatively for both local and distant disease with comparable accuracy as with MRI. MRI which is not available routinely in all centers may be omitted in these patients. However MRI still has an important role in patients with stenosing growths.

Conflict of Interest: Nil
Source of support:Nil

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