Fişa suspiciunii de plagiat / Sheet of plagiarism's suspicion	Indexat la: 88/07

Opera suspicionată (OS) Suspicious work	Opera autentică (OA) Authentic work

OS	JEDERÁN, É, HORVÁTH, K, GŐDÉNY, M. The accuracy of High Resolution Magnetic Resonance in local staging of rectal cancer. *AMM (Acta Medica Marisiensis),* vol.56, no.2, p.84-85, 2010.
OA	KLESSEN, C., ROGALLA, P., TAUPITZ, M., Local staging of rectal cancer: the current role of MRI, *Eur Radiol*, No. 17, p.379–389, 2007.

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The accuracy of High Resolution Magnetic Resonance in local staging of rectal cancer

Éva Jederán, Katalin Horváth, Mária Gődény

National Institute of Oncology, Radiological and Diagnostic Department

Objective: To assess the accuracy of preoperative staging of rectal cancer with magnetic resonance imaging (MRI) and illustrate the correlation of MR imaging with pathologic findings and clinical impact of MR imaging in this setting.
Methods: Total of 447 patients with rectal cancer between 01.04.2009-31.03.2010 underwent MRI in our department. 76 patients with suspected or confirmed rectal carcinoma had preoperative staging examination. Rectal cancer imaging protocol included T2-weighted imaging in the sagittal, coronal and axial planes alongside a high-resolution plane perpendicular to the rectum at the level of primary tumor, and fat suppressed contrast-enhanced MRI was performed. Histopathological results were used as gold standard.
Results: Rectal carcinoma was identified on MRI and confirmed histological in 24 patients. MRI findings were correctly of T category in T1 1/6 cases, in T2 4/9, T3 8/9, T4 5/6 cases. Accuracy was 70%
Conclusion: Comparing pretreatment MRI staging and post therapy histology assessment we concluded that high resolution MR (HRMR) is an accurate technique for prediction of rectal tumor stage. It allows identification of patients with extrarectal spread, who might benefit from preoperative radiation therapy and patients with minimal or no sphincteral involvement, who might be suitable for sphincter sparing surgery.

Keywords: Rectal cancer, staging, Magnetic Resonance Imaging, High Resolution Magnetic Resonance

Introduction

Rectal cancer is third most common cancer in the world. Over past few years, significant progress has been made in the management of rectal cancer. The therapeutic approach demands accurate preoperative tumor staging—namely, detection of rectal carcinoma infiltration into the mesorectal fat, involvement of the mesorectal fascia, and nodal involvement.

Total mesorectal excision (TME) is the standard surgical treatment of primary rectal cancer; remove of rectum together with the draining lymph nodes, anal sphincter preservation unless tumor encroached upon the anal sphincter complex and anatomic nerve preservation. In selected patients with involvement of the mesorectal fascia at the time of diagnosis, the use of preoperative radiation therapy is advocated.

Rectal cancer staging

The international TNM and UICC staging systems are the most widely used pathologic staging systems. They are based on the depths of tumor into and beyond the bowel wall, number of lymph node metastases and presence of distant metastases. T1 rectal carcinomas are confined to the mucosa and submucosa, T2 tumors invade the muscularis propria. T3 cancer extends beyond the lamina muscularis propria. T4 rectal cancers are defined as tumors that reach the peritoneal surface or adjacent organs [1].

Layers of the normal rectal wall – examined with MR

The advent of powerful gradient systems and the development of high-resolution phased array surface coil systems combine a very high spatial resolution with a large FOV that allows detailed evaluation of the intestinal wall and also depicts surrounding anatomy including the mesorectal fascia. On T2-weighted images the muscularis mucosal layer is shown as a fine low signal intensity line with a thicker high signal submucosal layer seen beneath. The perirectal fat appears as a high signal surrounding the low signal of the muscularis propria and contains signal void vessels. The mesorectal fascia is seen as a fine low signal layer enveloping the perirectal fat and rectum; this layer defines the surgical excision plane in total mesorectal resection.

Material and methods

For the examination of rectal cancer with MR no special patient preparation is required. At our department we have administered a spasmolytic agent (butyl scopolamine) at a dose of 20-40 mg to prevent movement artifacts due to bowel peristalsis.

The aim of the initial sequence was to localize the HR images in axial, sagittal and coronal planes into the plan of region for examination. The sagittal T2W-TSE slides were first diagnostic series which were unable to identify the primary tumor. The second and third sequences were performed with large field of view (FOV) in axial planes with T2W-TSE, STIR and T1W-TSE sequences for the whole pelvis (from the iliac crest to the symphysis pubis) for detecting distant lymph node metastasis. The core of examination was a high-resolution T2W-TSE sequence with small FOV and 3mm slice thickness (TR 3740ms, TE 139ms, FOV 160x160mm, Matrix 256x256mm, voxel size 0,7 x 0,6x 3 mm). It was mandatory to place the slice perpendicular to the longitudinal access of the tumor. With this sequence it was possible to evaluate precisely the tumor and its relationship to the intestinal wall and mesorectal fascia, the pelvic organs and also the peritoneal fold. Mesorectal lymph nodes could be evaluated in the immediate vicinity of the tumor. In order to detect infiltration

of the anal sphincter muscles, coronal T2W-TSE sequence parallel to the longitudinal access of the anal canal was performed. We also applied gadolinium contrast agent and used 3D T1W fat suppressed MR measurements.
The duration of the MRI protocol as just outlined was about 30 min.

Results

Total of 447 patients with rectal cancer between 01.04.2009 - 31.03.2010 underwent MRI in our department. 76 patients with suspected or confirmed rectal carcinoma had preoperative staging examination. Rectal carcinomas were identified on MRI and confirmed histologicaly in 24 patients.
All rectal tumors were adenocarcinomas, verified by histopathology examinations. MRI T staging were correct in T1 stage 1/6, in T2 stage 4/9, in T3 stage 8/9, in T4 stage 5/6 cases, average accuracy was 70% . Nodal (N) status was correctly determined in N0 stage 2/10 cases, N1 stage 12/17, N2 stage 2/5 cases (Table I). The accuracy was 54%.

Discussions

Detection and stadialisation of rectal cancers with MRI is largely based on differences in T2 signal intensity in following structures: tumor, mucosa and submucosal layers, muscular layer, perirectal fat, and mesorectal fascia. Lamina muscularis propria is the most important anatomic structure in the TNM staging systems. The tumor tissue has intermediate signal intensity among the high signal intensity fat tissue and the low signal intensity muscular layer. Furthermore, its signal intensity is higher than that of the mucosal and submucosal layers. At histopathological analysis, stage T1 is characterized by infiltration of the submucosal layer and sparing of the muscularis propria. However differentiation between stage T1 and T2 is rather difficult, because the spatial resolution of the phased-array surface coil MRI is not adequate to allow differentiation between the mucosal and submucosal layers. Stage T2 is generally characterized by involvement of the muscular layer. The muscular layer is partially reduced in thickness, although the outer border between the muscularis propria and the perirectal fat remains intact. In order to differentiate stage T2 and T3, the crucial criteria is involvement of the perirectal fat. This is characterized by lack of the interface between the muscular layer and the perirectal fat, with a rounded or nodular advancing margin. In stage T3, muscularis propria is totally disrupted and it cannot be distinguished from the perirectal fat.
In the evaluation of stage T3 is particularly important to determine the minimum distance between the tumor and the mesorectal fascia. In patients with suspected tumoral involvement in the mesorectal fascia, neoadjuvant treatments are advocated. In T4, the specific signal intensity can be seen infiltrating the surrounding structures. Infiltration of the extramural veins and peritoneal folds can also be identified by MRI. Accuracy of T staging with MRI as reported in the literature is 88-94%.
Identification of metastatic lymph nodes is the greatest challenge in preoperative rectal cancer staging. The lymph node size is not a reliable standard for metastatic involvement because micrometastases in normal sized lymph nodes are common. The N staging accuracy rates with MRI are reported in the literature between from 57 to 85%. [2,3,4,5,6,7,8]

Table I. High Resolution Magnetic Resonance – histology findings in Hungarian National Cancer Institute 01.04.2009-31.03.2010 (MRI = Magnetic resonance Imaging, N = lymph node, T = tumor)

Stage	MRI	Histology	Note
T1	1 (4,2 %)	6 (25,0 %)	1 patient local excision
T2	9 (37,5 %)	4 (16,7 %)	
T3	9 (37,5 %)	8 (33,3 %)	
T4	5 (20,8 %)	6 (25,0 %)	
N0	10 (41,7 %)	2 (8,3 %)	2 micrometastases
N1	12 (50,0 %)	17 (70,8 %)	1 micrometastasis
N2	2 (8,3 %)	5 (20,8 %)	2 micrometastases

Conclusions

Accurate preoperative assessment of rectal cancer is essential for a proper management of the treatment strategies. It must be individualized according to the depths of cancer invasion and degree of lymph node involvement. MRI imaging with phased array surface coil and HR protocol offer us best fulfill in clinical requirements for preoperative local staging in rectal cancer.
Rectal MRI has the benefits of multilane imaging and excellent contrast between tumor and perirectal fat which help to show precisely the tumor and its extent for surgical planning and staging. Furthermore patients undergoing multiple examinations have no risk of ionizing radiation and contrast nephrotoxicity with MRI.
The HRMR imaging is the best in clarifying the following aspects: (a) depths of tumor into and beyond the bowel wall, (b) relationship of the tumor and the adjacent organs, (c) differentiation of T2/T3 stage, (d) extramural vein involvement (EMVI), (e) possible infiltration of the peritoneal fold and (f) internal architecture of lymph nodes.

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