

MRI of Rectal cancer at 3 T: preoperative diagnosis and planning of sphincter-sparing surgery

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Objectives: Surgical resection of rectal cancer aims for local control of disease, preservation of the sphincter and genito-urinary functions and prolonged survival. Magnetic resonance imaging helps to identify patients with minimal sphincter involvement, who can avoid permanent colostomy. The purpose of this study was to assess the value of MRI at 3 Tesla in preoperative diagnosing, staging and surgical planning of rectal cancer and specifically to see if MRI can predict the suitability for sphincter sparing surgery.

Materials and Methods: Thirty-eight patients (male 24, female 14) with suspected rectal cancer underwent routine MRI scanning and dynamic contrast enhanced MRI (DCE-MRI) in the supine position after routine cleansing and luminal distension of the rectum. A 3T MR scanner (GE Signa Excite) was used with an 8-channel phased-array surface coil. The imaging protocol included coronal T2WI (FRFSE-XL), coronal T2FS (FRFSE-XL), sagittal T2WI (FRFSE-XL), sagittal T2FS (FRFSE-XL), axial T2WI (FRFSE-XL), axial T2FS (FRFSE-XL), axial T1WI (FSE-XL), axial T1WI (F-SPGR), axial T1FS (F-SPGR), 2D MR hydrography (SSFSE) and DCE-MRI (3D F-SPGR).

The image quality, artifact and demonstration of rectal tumors and rectal wall on these 11 different sequences were evaluated by 2 radiologists blinded to clinical information. The diagnosis and staging were made according to MRI findings and were correlated with the operative and pathologic findings. The distance from the lower margin of rectal cancer to the point where levator ani muscle attached to rectum was measured in order to predict the possible approach of sphincter sparing surgery.

Results: All rectal carcinomas were identified on MRI (Figure 1) and confirmed at histological examination to be invasive carcinoma in all 38 patients. Mean tumor size was 5.2 cm (range 2.5–10 cm). Pre-operative MRI diagnosed 37 of all 38 rectal carcinomas with an accuracy of 97.4%. MRI correctly predicted T stage in 34 patients (accuracy = 89.5%) (Table 1). Seventeen patients had lymph node metastases; MRI correctly identified 11 patients with lymph node metastases and 19 patients without (accuracy = 79.0%). Twenty-seven patients underwent sphincter-sparing resection of the rectum (SSR), and eight underwent abdominoperineal excision (APR). In 3 patients, the tumor could not be completely resected due to massive local infiltration and distal metastasis and was just given diverting colostomy. Using the distance from the lower margin of rectal cancer to the point of levator ani muscle attachment to rectum ≥ 3 cm as the criterion for sphincter sparing surgery, MRI accurately determined the surgical approaches in 36 out of 38 patients (94.7%).

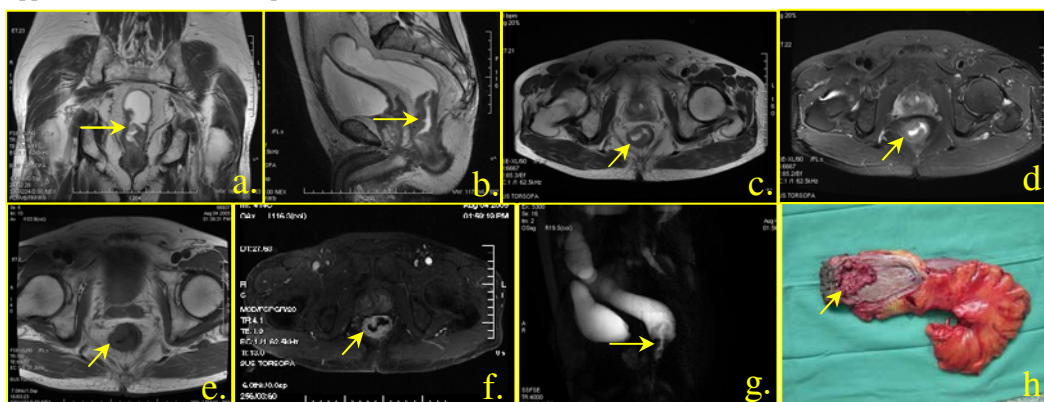


Fig. 1 MR images of a 75yo male with a T2 stage rectal adenocarcinoma: a) coronal T2WI (FRFSE-XL), b) sagittal T2WI (FRFSE-XL), c) axial T2WI (FRFSE-XL), d) axial T2FS (FRFSE-XL), e) axial T1WI (FSE-XL), f) DCE-MRI (3D F-SPGR), g) 2D MR hydrography (SSFSE) and h) specimen. An abdominoperineal resection was performed based on MRI findings.

Table 1 T-staging of rectal cancer

Stage	Pathology			
	T1+ 2	T3	T4	total
M	13	3	0	16
R	0	17	0	17
	0	1	4	5
total	13	21	4	38

Among the 11 sequences, reviewers felt that dynamic contrast enhancement scans provided the best depiction of tumor margins. T2-weighted sequences provided superior images than T1WI with less artifacts and better delineation of the tumor, while FSE sequence was superior to SPGR sequence on T1WI. The lesions were shown more clearly on images without fat suppression than those with fat suppression. MR hydrography demonstrated the rectal lumen with image quality similar to barium enema.

Conclusions: MR imaging of rectal cancer at 3T accurately predicts T-staging, lymph node metastases and the opportunity for sphincter sparing surgery. Although lymph node metastasis detection was the most challenging aspect, new contrast agents may address this issue in the future. Although our protocol involved 11 sequences, the reviewers felt that an adequate imaging protocol could be reduced to four sequences including coronal, sagittal, axial T2WI and dynamic contrast enhancement scan.

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