

Staging rectal cancer: endoscopic ultrasound and pelvic MRI

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Abstract

The success of pre-operative therapy over post-operative treatments means that a technique identifying prognostic factors pre-operatively is of potential benefit in modifying the intensity of pre-operative therapy according to risk of local or distant failure. Clinical trials incorporating robust and accurate assessment of prognostic factors and appropriate stratification of patients prior to therapy will enable objective comparison of treatment modalities and outcomes. Careful staging of rectal tumours results in selective pre-operative treatment strategies aimed at reducing local failure and distant failure in high risk patients.

Keywords: *Rectal cancer; endoscopic ultrasound; pelvic MRI; pre-operative therapy; post-operative treatment.*

Imaging and pre-operative strategies

Surgical and pre-operative treatment choices are best determined by multidisciplinary decision making based on detailed assessment of the primary tumour, as well as staging for the presence or absence of metastatic disease. The following prognostic factors are taken into consideration in the diagnosis and staging of rectal cancer by endoscopic ultrasound (EUS) and magnetic resonance imaging (MRI):

T-staging

EUS

By assessing tumour penetration (hypoechoic mass lesion) in relation to rectal wall layers, it is possible to provide an ultrasound T stage which correlates well with the T component of the TNM classification (Fig. 1)^[1]. Overstaging of T2 lesions is well described and is caused by peritumoral inflammation merging imperceptibly with primary tumour and can also occur with oblique scanning and over-distension of the coupling balloon. Conversely understaging occurs less commonly, and is the result of microscopic tumour infiltration below the resolution capabilities of ultrasound. A subgroup of

patients exists (\leq sm1 disease) who can be treated with curative intent by a variety of minimally invasive techniques at colonoscopy by performing endoscopic polypectomy and endoscopic mucosal resection (EMR). Although the 15-MHz miniprobe^[2] showed disappointing accuracy (37.1%) in distinguishing between the three subclasses of submucosal invasion (sm1, 2 and 3) a higher accuracy was achieved in discriminating between \leq sm1 (m and sm1) and \geq sm2 (85.7%).

MRI

MRI assessment using high spatial resolution techniques shows similar accuracy and limitations in T-staging as ultrasound. Both T1 and T2 tumours have a very high 5-year survival but the widest range in survival is demonstrated in patients with T3 tumours which comprise 80% of patients. For example, a T3 tumour with only 1–2 mm of extramural spread has an identical prognosis to T2 tumours. The successful identification of tumours with increasing extramural spread is of great importance as histopathology studies have shown poor survival in this group of patients. Using MRI, the majority of patients with tumour infiltrating 5 mm or over beyond the muscularis propria are correctly identified and

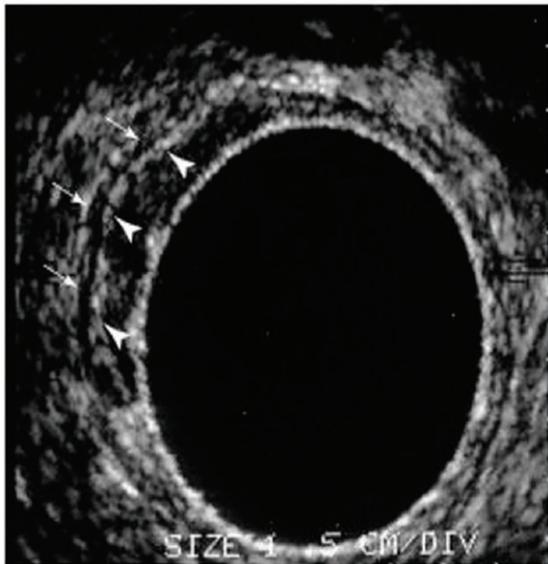


Figure 1 Superficial rectal tumour confined to mucosa (T1). Note the intact hyperechoic submucosa (arrowheads) medial to the muscularis propria (arrows). This was a moderately dysplastic tubulovillous adenoma on histopathology.

extramural depth, as measured using MRI, shows direct agreement with corresponding histopathological measurements. The anterior wall of the upper rectum is covered by the peritoneal reflection and transcoelomic spread with disseminated intra-abdominal disease will occur if there is ulceration through the peritoneum. Obvious tumour spread through and beyond the peritoneal reflection can be readily identified by MRI, but not by ultrasound. However, cases will be missed by MRI due to failure to resolve microscopic infiltration of peritoneal lined clefts.

Nodal staging

EUS

Lymph node assessment is less accurate than T staging with accuracies ranging between 64–83%. Studies have shown that the internal texture of an imaged node may correlate better with the presence of metastasis than nodal size, and that inhomogeneity and hilar reflectivity are important discriminators of nodal status. However, these features are not consistently reliable and the inability to identify nodes <5 mm in diameter is recognised as

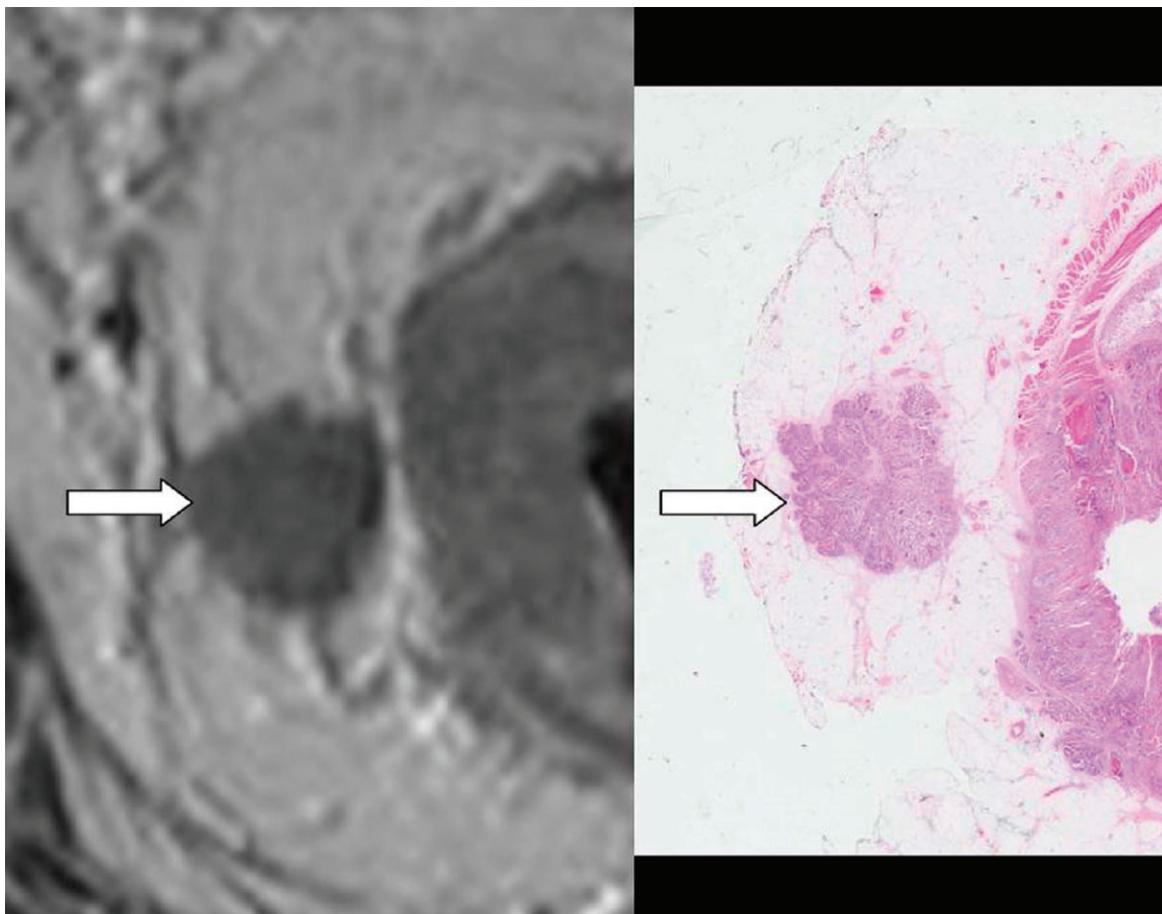


Figure 2 MRI and corresponding histopathology H&E stained section of a lymph node. The MRI shows a lymph node with an irregular border (arrow). The corresponding histopathology section shows this irregular border corresponds to tumour breach of the lymph node capsule.

a significant limitation of staging by EUS, with only 13% of positive lymph nodes measuring <5 mm in diameter being detected in one series.

MRI

It has been shown that mixed MR signal intensity within lymph nodes usually corresponds histologically to tumour deposits with areas of necrosis or extracellular mucin pools. Evaluation of the border contour of lymph nodes is also a good predictor of nodal status and more accurate than using size criteria. However, micrometastatic disease defined as tumour foci <2 mm within lymph nodes cannot be identified. MRI and EUS can be regarded as equivalent in assessment of T-stage, however MRI has clear advantages over EUS in nodal assessment since nodes within the entire mesorectum can be evaluated by MRI. In addition, MRI enables assessment of other crucial prognostic factors, namely extramural venous invasion and circumferential resection margin status^[3].

Extramural venous invasion

Extramural venous invasion is recognised on MRI by characteristic serpiginous extension of tumour signal into perirectal or pericolonic fat. Extramural venous invasion is a poor predictor of survival and is also the third strongest independent predictor of metastasis, after lymph node status and extent of local tumour infiltration. By careful correlation with histopathology specimens, high-resolution MRI can identify extramural vascular invasion (EMVI) and predicts post-operative histological EMVI with 80% accuracy. This feature is present in up to 30% of rectal cancers and can be used to stratify patients into clearly separate prognostic groups. Patients diagnosed with MRI-EMVI positive tumours have a significantly worse outcome and a greater than 50% risk of developing metastatic disease, compared with only 12% for patients who are MRI-EMVI negative.

The circumferential resection margin

The mesorectal fascia represents the potential circumferential resection margin (CRM) in patients undergoing radical total mesorectal excision (TME) surgery and its clear demonstration on MRI enables prediction of final CRM status following surgery^[4]. We define potential CRM involvement if tumour extends to within 1 mm of the mesorectal fascia on MR images (Fig. 2). It is well established that a positive CRM is associated with both local recurrence and poor survival. The pre-operative identification of this by MRI enables patients to benefit from therapy that causes tumour regression away from the potential CRM prior to surgery^[5].

Conclusion

Careful staging of rectal tumours results in selective pre-operative treatment strategies aimed at reducing local failure and distant failure in high risk patients.

References

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