

MRI staging has had a measurable impact on outcomes for patients with rectal cancer through the more selective use of preoperative therapies and the detailed anatomic assessment for surgical planning

The key to effective management is accurate and detailed staging assessment of the primary tumour that goes beyond the basic TNM classification.

The prerequisite for accurate staging is achieving good quality high spatial resolution MRI scans. The extra time spent in undertaking good quality scans is more than compensated by 1.) the ease of reading the scans compared with low resolution imaging and 2.) the ability to completely assess the anatomy of the rectal wall, extramural spread, vascular and nodal involvement by the tumour.

Scans should be performed using high resolution T2 weighted imaging. We define this by a voxel size of 1mm^3 or less. In obtaining consistently good quality high spatial resolution imaging, without the loss of signal to noise ratio and image degradation, it is necessary to increase the duration of the imaging acquisition time. The overall duration of the study itself need not be altered since the commonly used additional sequences in body imaging pay no useful role in the local staging of primary rectal cancer. Therefore, it is better to optimise and ensure complete coverage of the rectum and mesorectum in orthogonal planes to the rectal wall with T2 weighted imaging and omit STIR/T1/contrast enhanced/fat saturation and diffusion weighted sequences - which do not provide any significant added prognostic or treatment planning contribution compared with well performed, high resolution T2 weighted scans.

In order to achieve an optimised spatial resolution with T2 weighted Fast spin-echo sequences, the pixel size should be $0.6\text{mm} \times 0.6\text{mm}$. This is achieved by using a $160\text{mm} \times 160\text{mm}$ field of view with a 256×256 matrix or alternatively a 320×320 matrix with a $200\text{mm} \times 200\text{mm}$ field of view. In either situation, at least 4 or preferably 6 signal averages are needed to obtain thin section 3mm scans.

Even a minor loss of resolution by use of thicker slices or large field of view is associated with poorer staging accuracy which can have devastating consequences for patients.

Long term follow up data show that the staging of prognostic factors using high resolution techniques are as robust as post-operative pathological assessment of the resected specimen in predicting patient outcomes. Therefore future treatment strategies will place greater reliance on preoperative MRI assessment to plan definitive treatments.

Crucially, it is now possible to tailor the patient treatment plans according to the combination of anatomic and morphologic prognostic variable assessment by high resolution MRI.

The lecture will focus on the key elements in assessing rectal cancer using MRI that enable effective treatment planning by the multidisciplinary team. In 2015 and beyond the Radiologist will play an increasingly central role in helping those decision making processes.