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Diagnostic accuracy and value of magnetic resonance imaging (MRI) in planning exenterative pelvic surgery for advanced colorectal cancer

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Abstract ***Purpose:*** To assess the diagnostic accuracy of magnetic resonance imaging (MRI) in detecting colorectal tumour invasion according to seven intrapelvic compartments for planning exenterative pelvic surgery.

Method: Sixty-three consecutive patients underwent preoperative MRI planning for exenterative surgery, defined as operative excision beyond conventional mesenteric planes for locally advanced ($n = 23$) and recurrent ($n = 41$) pelvic colorectal cancer. The institutional research committee approved of the study and waived the need for a consent form as the images were retrospectively assessed. Two radiologists reported tumour invasion for each of seven anatomic surgical resection compartments, blinded to histopathology and the intraoperative findings. Sensitivity, specificity and predictive values were calculated for the seven intrapelvic compartments. Cox regression analysis was used to calculate the risk of death and recurrence. Overall interobserver agreement was assessed using Cohen's Kappa coefficient (k).

Results: The sensitivity of MRI was $\geqslant$93.3% in all but the lateral compartment where it was 89.3%. Specificity for the posterior (82.2%) and anterior compartments below the peritoneal reflection (86.4%) was lower compared to the other compartments. Agreement between the

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two radiologists was found to be good or very good for all compartments ($k > 0.72$). An MRI diagnosis of tumour invasion in the anterior compartment above the peritoneal reflection was associated with a poorer survival ($p = 0.012$).

Conclusion: MRI is accurate in predicting the extent of colorectal tumour within the pelvis and therefore can be used to determine the type of surgery required for curative resection. It should always be used to stage patients with advanced colorectal pelvic cancer.

1. Introduction

Exenterative pelvic surgery has been used for patients with locally advanced primary and recurrent colorectal cancer. Published data show that radical resection can achieve complete tumour clearance (R0) and can significantly increase survival.[1–3] Surgery is only considered curative, however, when the histopathological margins are clear of tumour. The R0 rate has been reported to range from 22% to as high as 67%.[4] The potential cure rates achievable by this type of surgery need to be balanced against the morbidity. The quality of life (QoL) of patients is reduced if bowel, urinary or sexual function is affected and surgery may, therefore, not be suitable for all patients with extensive pelvic malignancy. Careful selection is vital.

In the authors' institution, selection of patients for surgery is performed using computerised tomography (CT), magnetic resonance imaging (MRI) and positron emission tomography (PET). MRI has been shown to be valuable not only in the diagnosis and staging of pelvic malignancies but also in the accurate depiction of the anatomical structures and compartments relevant to surgery and neo-adjuvant therapy planning.[5,6] It is used, therefore, as the primary radiological modality for local staging and surgical planning. Previous studies have shown MRI to be highly accurate in detecting tumour invasion into pelvic structures such as the prostate, seminal vesicles and the sacrum (Fig. 1)[7,8], with one study also showing MRI to have high specificity.[9]

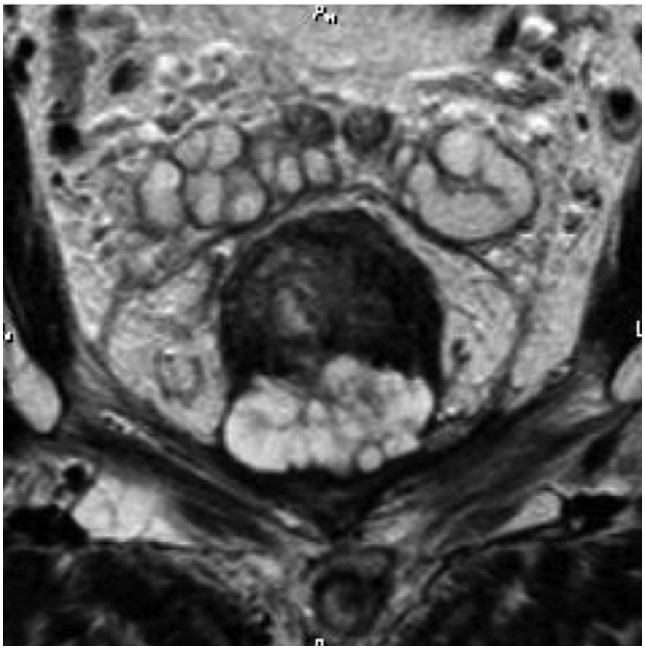

Fig. 1. Axial T2-weighted magnetic resonance imaging (MRI) demonstrating mucinous adenocarcinoma invading the posterior compartment.

There is, however, little evidence regarding the efficacy of MRI in facilitating surgical planning for exenterative surgery. The complexity and unpredictability of the distribution and anatomical relationships of extensive primary and especially recurrent pelvic cancer, led us to devise a system for the assessment of tumour by MRI in which the pelvis is divided into seven anatomical compartments. The aim of the present study was to assess the diagnostic accuracy of MRI in detecting colorectal tumour invasion according to seven intrapelvic compartments for planning exenterative pelvic surgery.

2. Method

2.1. Study design and subjects

The study was reviewed and approved by the institutional research committee. Consecutive patients treated for locally advanced rectal or recurrent colorectal pelvic cancer by a single surgical team between March 2006 and August 2010 were included. MRI scanning was performed as part of pre-operative staging. The decision for surgery was taken during the multidisciplinary meeting based on a combination of tumour marker measurement, colonoscopy, examination under anaesthesia, radiological staging and pre-operative biopsies. All resected specimens were examined by a dedicated gastrointestinal histopathologist. The interpretation of the MRI images using the proposed pro-forma was performed retrospectively and blinded to the initial reporting, operative and histopathological findings. The individual pro-forma scoring was compared with the intraoperative and histopathological findings (reference standard). The study followed the guidelines proposed by the Standards for the Reporting of Diagnostic accuracy studies (STARD criteria).[10]

2.2. Inclusion and exclusion criteria

Locally advanced primary or recurrent colorectal intrapelvic cancers were included in the study. Other