3-T MRI with phased-array surface coil in the local staging of rectal cancer

RM a 3 T con bobina phased array nella stadiazione loco-regionale del carcinoma rettale

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Abstract

Purpose. This study sought to evaluate the diagnostic accuracy of surface-coil 3T magnetic resonance (MR) imaging in the preoperative study of patients with rectal cancer.

Materials and methods. Thirty patients with histologically proven rectal cancer underwent surface-coil 3T MR imaging with sagittal, paracoronal and para-axial T2-weighted turbo spin echo (TSE) sequences. Slice thickness was 3 mm without gap, field of view 24 cm, matrix 400 x 512. Images were assessed for infiltration of the rectal wall, perirectal fat and pelvic structures. Tumours were staged according to the TNM system, and the MR imaging results were correlated with histopathology.

Results. In the patients who underwent MR imaging before and after radiotherapy (group 1), the diagnostic accuracy of 3T MR imaging was 88% for T2, 94% for T3 and 88% for T4 cancers. In those who underwent surgical treatment without preoperative radiotherapy (group 2), the diagnostic accuracy was 90% for T2, 87% for T3 and 87% for T4 cancers.

Conclusions. The high signal-to-noise ratio coupled with a large field of view enables surface-coil 3T MR imaging to achieve high levels of diagnostic accuracy in the local staging of rectal cancer, and in particular in assessing infiltration of mesorectum and mesorectal fascia.

Keywords 3T MRI · Local staging · Rectal cancer

Riassunto

Obiettivo. Obiettivo del nostro lavoro è stata la valutazione della accuratezza diagnostica della bobina di superficie della risonanza magnetica (RM) a 3 T nello studio preoperatorio dei pazienti con tumore del retto.

Materiali e metodi. Trenta pazienti con riscontro istologico di tumore del retto sono stati sottoposti a RM 3 T con bobina di superficie. Sono state eseguite sequenze turbo spin echo (TSE) T2 sagittali, para-coronali e para-assiali, spessore immagine 3 mm senza gap, field of view (FOV) 24 cm, matrice acquisizione 400x512. È stata valutata l’infiltrazione della parete rettale, del grasso perirettale, l’infiltrazione degli organi endopelvici. I tumori sono stati stati diagnostici secondo la classificazione tumore-noduli-metastasi (TNM) e i risultati di RM sono stati comparati con quelli anatomo-patologici.

Risultati. Nei pazienti esaminati prima e dopo terapia neoadiuvante (gruppo 1) i valori di accuratezza diagnostica della RM 3 T sono stati 88% per T2, 94% per T3, 88% per T4, valore medio 92%, nei pazienti sottoposti a intervento chirurgico senza terapia neoadiuvante (gruppo 2) l’accuratezza diagnostica è stata 93% per T2, 79% per T3, 86% per T4, valore medio 86%; l’accuratezza globale è stata 90% per T2, 87% per T3, 87% per T4, valore medio 89%.

Conclusioni. L’alto rapporto segnale-rumore associato a campi di vista ampi consente alla RM 3 T una elevata accuratezza diagnostica nella stadiazione loco-regionale del tumore rettale.
Colon carcinoma is one of the most common malignancies in industrialised countries, and location in the rectum–sigmoid is seen in 60%–70% of cases [1–3]. Once a histological diagnosis of rectal carcinoma has been established, a series of parameters need to be defined, which are essential for planning treatment and which include depth of wall infiltration, mesorectal infiltration, circumferential resection margin (CRM), invasion of surrounding structures and presence of distance metastasis. In fact, whereas tumours confined to the rectal wall can be treated radically by local excision alone, those that infiltrate the mesorectal fat require more extensive surgery, such as total mesorectal excision (TME) or abdominoperineal resection [3–9]. Additionally, stages T3 and T4 cancers [1, 2] and those that infiltrate the upper portion of the anal canal are also subjected to neoadjuvant chemoradiotherapy with the aim of downstaging the tumour, a practice that has proved effective in improving outcome and permitting a more conservative surgical treatment [2].

Accurate preoperative assessment is therefore fundamental for directing management decisions [10–16], and in this context, imaging plays an increasingly important role. Among the imaging modalities used for disease staging, endorectal ultrasound is considered the reference standard for evaluating the depth of wall infiltration; however, it suffers significant diagnostic limitations in evaluating extraparietal disease extent (mesorectum and adjacent organs) and regional lymph nodes [3, 17, 18], as well as being difficult to perform in severely stenosing tumours.

Multidetector computed tomography (MDCT), despite the significant recent improvement in staging effectiveness, still has limitations in contrast resolution that preclude adequate local staging of tumours of the middle and lower rectum, has limitations in contrast resolution that preclude adequate local staging of tumours of the middle and lower rectum, whereas tumours confined to the rectal wall can be treated radically by local excision alone, those that infiltrate the mesorectal fat require more extensive surgery, such as total mesorectal excision (TME) or abdominoperineal resection [3–9]. Additionally, stages T3 and T4 cancers [1, 2] and those that infiltrate the upper portion of the anal canal are also subjected to neoadjuvant chemoradiotherapy with the aim of downstaging the tumour, a practice that has proved effective in improving outcome and permitting a more conservative surgical treatment [2].

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Numerous studies have demonstrated the ability of magnetic resonance (MR) imaging with phased-array coil to evaluate infiltration of the rectal layers, extension to the mesorectum and possible involvement of adjacent organs, reporting levels of accuracy that have made it the most accurate imaging technique for staging rectal cancer [1, 3, 20–22]. Nearly all such studies were, however, conducted with 1.5-T magnets and very few with systems operating with 2.0–2.5-T magnets and even fewer with 3.0-T systems. The latter, however, have shown significant recent improvement in staging effectiveness, still has limitations in contrast resolution that preclude adequate local staging of tumours of the middle and lower rectum, whereas tumours confined to the rectal wall can be treated radically by local excision alone, those that infiltrate the mesorectal fat require more extensive surgery, such as total mesorectal excision (TME) or abdominoperineal resection [3–9]. Additionally, stages T3 and T4 cancers [1, 2] and those that infiltrate the upper portion of the anal canal are also subjected to neoadjuvant chemoradiotherapy with the aim of downstaging the tumour, a practice that has proved effective in improving outcome and permitting a more conservative surgical treatment [2].

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