Comprehensive MRI-Based Staging of Rectal Cancer. Beneficial Combination of Local High-Resolution Imaging and a Moving-Table Platform for Simultaneous Detection of Metastasis

57-year-old male patient with stage T4b rectal cancer (seminal vesicles, prostate) with extramural vascular invasion (arrow). Comprehensive MRI-based staging with high-resolution T2w TSE (1A), DCE-MRI (1B), DWI (1C) and ADC map (1D), HASTE-TIRM using TimCT Oncology (1E), post-processing with Tissue 4D (1F). Images have been acquired using a 1.5T MAGNETOM Aera.
Although local tumor control is already established for rectal cancer due to multimodal therapy, its inherent tendency to metastasize still represents an unsolved problem and poses a major challenge for upcoming diagnostic and therapeutic strategies. Whilst standard long-course neoadjuvant chemoradiation has been shown to reduce the risk of local recurrence, nevertheless it demonstrates no substantial influence on the biological behavior of potential metastasis. In this context, the study by Ayez et al. [1] recommended the restaging of locally advanced rectal cancer by chest and abdominal CT after completion of long-course neoadjuvant therapy, given that additional findings may alter the treatment strategy.

In this setting, comprehensive staging algorithms using a single diagnostic modality would be highly reasonable. Specialized magnetic resonance imaging (MRI) is known to be the pivotal staging tool for locally advanced rectal cancer and particularly addresses the extent of mesorectal infiltration and the status of circumferential resection margin, which is known to be the most important prognostic indicator [2]. Whole-body MRI using a continuously moving patient table like in TimCT Oncology was originally developed at our institution in 2005 and clinically established in 2006 [3,4]. The Sliding Multislice application covers thorax, abdomen, and pelvis for staging of distant spread, especially to lungs, liver, nodes, and bone. Moving table MRI with Sliding Multislice has proved to greatly benefit scan efficiency and diagnostic accuracy when combined with local high-resolution rectal cancer staging. With the adoption of this exciting technique, true comprehensive MRI-staging of rectal cancer is now possible and has gained substantial acceptance amongst colorectal surgeons, radiation oncologists, and oncologists. Technological advances enabled further diversification of our imaging protocol adding pelvic and upper abdomen diffusion-weighted imaging (DWI) and local dynamic contrast-enhanced (DCE)-MRI using the Tissue 4D platform for post-processing. To better characterize early response to neoadjuvant chemoradiation and to a greater extent predict tumor aggressiveness would require multiparametric MRI which, in our opinion, will be the next logical step towards future-oriented comprehensive MRI-based staging of rectal cancer.

56-year-old male with stage T4a rectal cancer. Multiparametric imaging at 1.5T MAGNETOM Aera. (2A) Morphological overview, (2B) Diffusion-weighted imaging with a b-value of 1000 s/mm², (2C) ADC tumor 0.742 × 10⁻³ mm²/s (green arrow) and node 0.692 × 10⁻³ mm²/s (orange arrow). (2D) Post-processing with syngo Tissue 4D for color coded parametric maps, curves, and histograms.
73-year-old male with advanced rectal cancer. MRI before (3A) and after (3B) neoadjuvant chemoradiation. ypT3N2a(5/14), regression grade 3 (> 50% vital tumor cells) progression of lung metastases (arrows). Images have been acquired using a 1.5T MAGNETOM Avanto.

References

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