Maastricht University

MR imaging for rectal cancer staging

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Summary

Aims of this thesis were to investigate how well novel staging concepts in rectal cancer have been integrated into daily routine, how they can influence treatment management, what are the main challenges, and how can we best address these to further optimize and harmonize the quality of rectal cancer reporting in the future.

In Chapter 2 we provided an MRI pictorial focused on key anatomical concepts crucial for rectal cancer treatment planning, response evaluation and postoperative assessment. These include for example the anatomy of the rectal wall in relation to T-staging, anatomical landmarks used to define the boundaries of the rectum, detailed anatomy of the mesorectal fascia, peritoneum and peritoneal reflection, and key aspects of post-treatment anatomy after radiotherapy and after different surgical resection and reconstruction techniques. This pictorial may serve as a teaching atlas for residents, radiologists and other clinicians, and aid in enhancing their understanding of the MRI anatomy of the rectum and its surroundings, which is pivotal to ensure high-quality diagnostic evaluation and reporting.

In Chapter 3 we focused on the sigmoid take-off (STO), a recently introduced anatomical landmark to distinguish rectal from sigmoid cancer on imaging. Using a new web-based platform, we investigated the reproducibility of the STO in an international study set up including 11 radiologists and 6 colorectal surgeons with varying expertise levels. They assessed the MRIs of 155 patients, previously staged and treated as upper rectal/rectosigmoid tumours, and re-classified them using the STO as either rectal or sigmoid. We observed that this re-classification could in retrospect have affected treatment planning in approximately one fourth of the study patients. Agreement among expert radiologists was good, but there was considerable variations among the less experienced readers. We identified several interpretation pitfalls that likely contributed to this variation and that may serve as a basis for further teaching and protocol optimization.

One of these pitfalls was the varying angulation of oblique-axial imaging planes on MRI, which may hamper consistent evaluation of the STO. In Chapter 4 we evaluated the benefit of adding a consistent axial imaging plane in the form of a true-axial CT scan. One senior and one junior radiologists first evaluated the STO to classify tumours as rectal or sigmoid on MRI only (with varying oblique-axial planes), and then using a combination of MRI and CT. Although it did not improve the agreement between the two readers, the addition of a consistent true-axial plane (provided by CT) did improve the diagnostic confidence for the junior radiologist in over one-third of the study cases.

In Chapter 5 we retrospectively analysed 712 patients from 8 teaching hospitals in the Netherlands to assess how novel concepts for risk stratification such as EMVI, updated criteria for nodal staging, and subclassification of high versus low risk T-stage according to the depth of extramural invasion, have been adopted into routine clinical reporting following Dutch guideline updates. We observed a significant increase in the reporting of these items over a seven year timespan, accompanied by a vast increase in the use of structure reporting templates (from ±2 to 30%) and an overall trend towards improved completeness of reporting. In addition, a dedicated expert radiologist restaged the whole patient cohort according to most recent guideline criteria. Compared to the original staging reports, this led to a change in risk classification and could thus have impacted treatment management in approximately 18% of the study cases.

In Chapter 6 we developed an online case-based survey, which was completed by 322 radiologists and clinical colleagues worldwide, to identify what are the main problem areas when applying the TNM 8th staging system for the radiological staging of rectal cancer. Sixteen problem areas were identified, related to cT-stage categorization in case of involvement of the anal canal, which structures to include in the definition of cT4b disease, how to define MRF involvement by the primary tumour and other tumour-bearing structures, how to differentiate and report lymph nodes versus tumour deposits, and how to stage lateral lymph nodes. These problem areas were discussed by an international multidisciplinary panel of experts, who provided practical recommendations on how to handle them, aiming to contribute to improved consistency in radiological staging and reporting in the future.