Editors' pick

Definition and validation of a radiomics signature for loco-regional tumour control in patients with locally advanced head and neck squamous cell carcinoma

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What was your motivation for initiating this study?

Locally advanced head and neck squamous cell carcinoma (HNSCC) shows a heterogeneous response to primary radiochemotherapy. Imaging biomarkers from radiomic analyses may supplement known risk factors to reflect the individual tumour's aggressiveness and to improve patient stratification for future interventional clinical trials. Within the German Cancer Consortium – Radiation Oncology Group (DKTK-ROG), data from a multicentre retrospective HNSCC patient cohort were collected for biomarker development [1], and more will be gathered from a prospective cohort for validation (www.clinicaltrials.gov, NCT02059668). We aimed to develop a prognostic model for loco-regional control (LRC) that combined clinical and computed tomography (CT) imaging features based on the retrospective DKTK-ROG cohort. This model will be validated on the prospective cohort once the data are available. We thus intend to provide clinical evidence regarding the value of radiomic analyses in outcome predictions for HNSCC.

What were the main challenges during the work?

In radiomics studies, a high-dimensional feature space of correlated and not always reproducible features is usually obtained after feature extraction from imaging. Therefore, the main difficulty was to consider methods for pruning the feature space to reduce it to non-redundant and robust features before modelling. In addition, we aimed specifically to identify imaging features that were independent of the tumour volume and provided extra information to our model.

What is the most important finding of your study?

We developed and validated a model for the prognosis of LRC in locally advanced HNSCC that contained the clinical parameter tumour volume and two additional, independent CT-imaging biomarkers. An improved prognosis was observed by combining the clinical model with the radiomics model not only in the discovery cohort but also in an independent (retrospective) validation cohort. The improvement was visible in the discriminative performance of the model as well as in patient stratification into groups at low and high risk of loco-regional recurrence.

What are the implications of this research?

Addition of different levels of information to a model may be a way to improve its prognostic capabilities, as we observed when we combined clinical and radiomics features. The developed model will be validated on the prospective cohort of the DKTK-ROG that is currently in the final monitoring phase. Successful prospective validation would provide evidence for the value of radiomic analyses for outcome prediction in HNSCC.

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Reference:

[1] Linge A, Lohaus F, Löck S, Nowak A, Gudziol V, Valentini C, et al. HPV status, cancer stem cell marker expression, hypoxia gene signatures and tumour volume identify good prognosis subgroups in patients with HNSCC after primary radiochemotherapy: A multicentre retrospective study of the German Cancer Consortium Radiation Oncology Group (DKTK-ROG). Radiother Oncol 2016;121:364–73.