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Longitudinal radiomics using CBCT for prognosis in non-small cell lung cancer

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Introduction
The prognostic value of radiomics for non-small cell lung cancer (NSCLC) patients has been investigated for images acquired prior to treatment, but no prognostic model has been developed that includes the change of radiomic features during treatment. Therefore, the aim of this study was to investigate the potential added prognostic value of a longitudinal radiomics approach using cone-beam computed tomography (CBCT) for NSCLC patients.

Materials and methods
This retrospective study includes a training dataset of 141 stage I-IV NSCLC patients and three external validation datasets of 94, 61 and 41 patients, all treated with curative intended (chemo)radiotherapy. The change of radiomic features extracted from CBCT images was summarized as the slope of a linear regression. The CBCT slope-features and CT-extracted features were used as input for a Cox proportional hazards model. Moreover, prognostic performance of clinical parameters was investigated for overall survival and locoregional recurrence. Model performances were assessed using Kaplan-Meier curves and c-index.

Results
The radiomics model (Figure 1, model 1.1) contained only CT-derived features and reached a c-index of 0.63 for overall survival and could be validated on the first validation dataset. No model for locoregional recurrence (model 1.2) could be developed that validated on the validation datasets. The clinical parameters model could not be validated for either overall survival (model 3.1) or locoregional recurrence (model 3.2).

Conclusions
In this study we could not confirm our hypothesis that longitudinal CBCT-extracted radiomic features contribute to improved prognostic information. Moreover, performance of baseline radiomic features or clinical parameters was poor, probably affected by heterogeneity within and between datasets.

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