

Background: Emerging data suggest that radiomics can be used to predict HNSCC outcomes. At present, only few data are available for baseline-MRI (b-MRI).

Methods: The training set (TS) and validation set (VS) were retrieved from pre-existing datasets (HETeCo and BD2Decide trials, respectively). Only patients with both pre- and post-contrast enhancement T1 and T2-weighted b-MRI and at least 2 years (y) of follow-up (FUP) were selected. The combination of the best extracted radiomic features (RFs) was used to classify low risk (LR) vs. high risk (HR) of disease recurrence. The radiomic model performance was evaluated on both TS and VS. Sensitivity, specificity and area under the curve (AUC) were computed. Overall Survival (OS) and 5y-disease-free survival (DFS) Kaplan-Meier (KM) curves were compared for LR vs. HR. The radiomic-based risk class was used in a multivariate Cox model, including well-established clinical prognostic factors (TNM, sub-site, HPV).

Results: In total, 57 patients of TS and 137 of VS were included. Of the 2553 RFs extracted, 3 (*T1w_original_glszm_SizeZoneNonUniformity*, *T1wCont_waveletLLL_ngtdm_Complexity* and *T2w_waveletHLL_gldm_DependenceVariance*) were selected for the signature. Sensitivity of recurrence risk classifier was 0.82 and 0.77, specificity was 0.78 and 0.81, AUC was 0.83 and 0.78 for TS and VS, respectively. The signature was found to be an independent prognostic factor for VS 5y-DFS and OS ($p=0.0001$ and $p<0.0001$, respectively). VS KM curves for LR vs. HR groups significantly differed both for 5y-DFS ($p=0.0001$) and OS ($p<0.0001$). In VS, comparing LR vs. HR, 5y-DFS was 88% [71%-95%] vs. 27% [16%-46%] and OS was 70% [59%-84%] vs. 44% [31%-62%]. A combined model of RFs plus TNM improved prognostic performance as compared to TNM alone, both for VS 5y-DFS (C-index: 0.76 vs. 0.60) and OS (C-index: 0.74 vs. 0.64).

Conclusions: Radiomics of b-MRI can help to predict recurrence and survival outcomes in HNSCC.