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09) Tumor Texture Features of Head and Neck Squamous Cell Carcinoma from Different Primary Sites Differ Significantly and Impact on the Performance of Machine Learning Prediction Models

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PURPOSE

Radiomic studies for prediction of clinical and molecular endpoints of head and neck squamous cell carcinoma (HNSCC) frequently combine tumors from different primary sites, with the assumption that the tumor texture features are not site dependent. We studied here whether texture features from different sites vary significantly and whether these variations affect the performance of machine learning models.

METHOD AND MATERIALS

603 contrast enhanced pre-treatment neck CT scans were evaluated from patients diagnosed with HNSCC, with tumors arising in the larynx or hypopharynx (LHP), lip & oral cavity (OC), and oropharynx (OP), further stratified based on HPV status to avoid its confounding effects. First order texture features with additional filtrations were extracted from each tumor and used in conjunction with patient age, smoking status, drinking status, and tumor T-stage to construct models for predicting nodal status and the presence of lymphovascular invasion (LVI) and perineural invasion (PNI). Statistical analysis was performed using Wilks test and Roy's largest root test to evaluate for variations in texture features based on tumor primary site. Two machine learning approaches (Random Forests (RF) and support vector machine (SVM)) were used to construct prediction models , using separate training (70%) and independent testing (30%) sets.

RESULTS

There were statistically significant differences ($P < 0.05$) between texture features of tumors arising in the OC, LHP, and OP. To evaluate whether the differences in texture features could affect prediction model performance, the models were constructed using texture data from the entire population or texture data stratified based on primary tumor site. Sub-stratification of texture data based on primary tumor site resulted in up to 14 % improvement in accuracy of prediction model compared to models using the combined datasets.

CONCLUSION

Significant differences in texture features exist for HNSCC arising from different primary sites below the hard palate, which can impact the performance of prediction models. For optimal performance and reliability, radiomic studies may have to stratify patients based on primary tumor site.

CLINICAL RELEVANCE/APPLICATION

Radiomic analysis can be used to predict various clinical endpoints of interest but the features can vary based on HNSCC primary site, which should be taken into account in clinical investigations using radiomic analysis of HNSCC.

FIGURE (OPTIONAL)

** no data entered **

Disclosures:

Nothing to disclose: Xiaoyang Liu

Nothing to disclose:	Nikesh Muthukrishnan
Nothing to disclose:	Behzad Forghani
Nothing to disclose:	Eugene Yu
Nothing to disclose:	Sahir Bhatnagar
Nothing to disclose:	Caroline Reinhold
Stockholder, Real-Time Medical, Inc Founder, 4 Intel Inc Stockholder, 4 Intel Inc Consultant, General Electric Company Speaker, General Electric Company	Reza Forghani

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