Head and neck cancer researchers demonstrate the capability of a deep learning algorithm in the post-surgery setting

October 22 2022

"This type of research is key since it can help identify patients with high-risk, aggressive head and neck cancer, and also help select appropriate patients for therapy de-escalation," says Dr. Benjamin Kann, who led the study. Credit: Artificial Intelligence in Medicine Program, Brigham and Women's Hospital

Artificial intelligence can augment current methods to predict the risk that head and neck cancer will spread outside the borders of neck lymph nodes, according to researchers with the ECOG-ACRIN Cancer Research Group (ECOG-ACRIN). A customized deep learning algorithm using standard computed tomography (CT) scan images and associated data contributed by patients who participated in the E3311 phase 2 trial shows promise, especially for patients with a new diagnosis of human papillomavirus (HPV)-related head and neck cancer. The E3311 validated dataset carries the potential to contribute to the more accurate staging of disease and prediction of risk.

Benjamin Kann, MD (Dana-Farber Cancer Institute, Brigham and Women's Hospital, Harvard Medical School), led the study for ECOG-ACRIN. He will present the findings during the American Society of Radiation Oncology (ASTRO) annual meeting in San Antonio, Texas.

"This type of research is key since it can help identify patients with high-risk, aggressive disease and also help select appropriate patients for therapy de-escalation," said Dr. Kann.

Head and neck cancers and their standard treatments—surgery, radiation, or chemotherapy—carry significant morbidity. They affect how a person looks, talks, eats, or breathes. Therefore, there is great interest in developing less intense treatment strategies for patients. For example, the completed E3311 phase 3 trial showed that low-dose radiation at 50 Gray (Gy) without chemotherapy following transoral surgery led to very high survival and outstanding quality of life in patients at medium risk for recurrence (Ferris RL. *J Clin Onc*. December 2021).

Dr. Kann and colleagues developed and validated a neural network-based deep learning algorithm based on diagnostic computed tomography (CT) scans, pathology, and clinical data. The source was the cohort of

participants in the E3311 trial who were assessed at high risk of recurrence by standard pathologic and clinical measures.

"Staging of head and neck cancer is a challenging clinical problem," said Dr. Kann. "In particular, our current efforts to identify extranodal extension via human interpretation of pre-treatment imaging have generally shown poor results."

Among the factors that determine the cancer stage are the size of the original tumor, the number of lymph nodes involved, and extranodal extension—when malignant cells spread beyond the borders of the neck lymph nodes into the surrounding tissue. In E3311, patients were assessed as high risk if there was ≥1 mm extranodal extension (ENE). These patients were assigned to chemotherapy and high-dose radiation (66 Gy) following transoral surgery.

Dr. Kann and colleagues obtained pre-treatment computed tomography (CT) scans and corresponding surgical pathology reports from the E3311 high-risk cohort, as available. From 177 collected scans, 311 nodes were annotated: 71 (23%) with ENE and 39 (13%) with ≥1 mm ENE.

The tool showed high performance in predicting ENE, substantially outperforming the reviews by expert head and neck radiologists.

"The deep learning algorithm accurately classified 85% of the nodes as having ENE compared to 70% by the radiologists," said Dr. Kann. "As to specificity and sensitivity, the deep learning algorithm was 78% accurate versus 62% by the radiologists."

The team plans to evaluate the dataset as part of future treatment trials for head and neck cancer. The algorithm will be assessed for its potential to improve upon current disease staging and risk assessment methods.

"Our ability to develop biomarkers from standard CT scan images is an exciting new area of clinical research and provides the hope that we will be able to better tailor treatment for individual patients, including deciding when to best use surgery and in whom to reduce the extent of treatment," said senior author Barbara A. Burtness, MD.

More information: 141 Screening for Extranodal Extension with Deep Learning: Evaluation in ECOG-ACRIN E3311, a Randomized De-Escalation Trial for HPV-Associated Oropharyngeal Carcinoma, plan.core-apps.com/myastroapp2 … c7071c5947c71a441519

Provided by ECOG-ACRIN Cancer Research Group