Medical Xpress

AI enabled body composition analysis predicts outcomes for patients with lung cancer treated with immunotherapy

May 23 2024

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Medicine (AIM) Program at Mass General Brigham and a senior resident physician at the Harvard Radiation Oncology Program, is the lead author of a paper published in *JAMA Oncology*.

Chaunzwa and senior author Hugo Aerts, Ph.D., director of the AIM Program, and associate professor at Harvard University, shared highlights from their paper.

How would you summarize your study for a lay audience?

As treatments like immunotherapy improve cancer survival rates, there is a growing need for clinical decision-support tools that predict treatment response and patient outcomes. This is particularly important for lung cancer, which remains the top cause of cancer death globally.

Previous studies linked body mass index (BMI) with lung cancer outcomes and immunotherapy drug side effects. However, BMI is a limited measure that doesn't capture details about different body tissues and their interaction with cancer therapies.

We used medical imaging and artificial intelligence (AI) to analyze body composition in a large cohort of patients with lung cancer that has spread to other parts of the body. Our study found that changes in muscle mass and fat quality during treatment are important indicators of outcomes for this population.

What knowledge gaps does your study help to fill?

As we continue to improve the treatment of advanced lung cancer with different systemic agents, including immunotherapy drugs, biomarkers that are both prognostic and predictive of treatment response are increasingly needed to inform clinical decisions. Prior studies identified an association between BMI and lung cancer outcomes.

An association between BMI and the incidence of side effects with immunotherapy has also been elucidated. However, BMI alone is a crude metric that does not capture the distribution and relative contributions of different body tissues.

Medical imaging-based analyses of body composition are being increasingly explored; however, in the setting of advanced non-small cell lung cancer (NSCLC), studies have been limited by small sample sizes and manual and difficult-to-reproduce methodologies.

How did you conduct your study?

We set out to perform comprehensive body composition analysis in large cohorts of individuals treated for advanced or metastatic lung cancer with different systemic drugs. We developed a robust end-to-end AI-based platform to assist with this task.

What did you find?

We found that while the distribution of different tissue compartments at the start of cancer-directed treatment had some value, the change in these measurements over the course of treatment was more strongly associated with patient outcomes.

Specifically, we found that loss in muscle mass was a poor prognostic factor in patients treated with chemotherapy, immunotherapy, or chemoimmunotherapy. Interestingly, among patients receiving immunotherapy, either alone or in combination with chemotherapy, changes in the quality of the fat under the skin (subcutaneous adipose tissue), as seen on CT scans, were also associated with the risk for lung cancer progression or mortality.

What are the implications?

This study presents key breakthroughs that will help advance the prognostication and surveillance of patients receiving immunotherapy for NSCLC. The first breakthrough is the implementation of an automated AI-based pipeline for comprehensive body composition analysis at scale in a diverse population of patients receiving immunotherapy and cytotoxic chemotherapy for advanced NSCLC. This is the largest and most extensive such study, incorporating both real-world data and prospective clinical trial cohorts, with longitudinal collection of multimodal data and extended follow-up to monitor disease response to therapy.

Our results demonstrate the potential of this analysis framework to provide a more nuanced understanding of the relationship between body composition and response to immunotherapy in NSCLC compared to crude BMI measurements. This may have important clinical implications for patient selection, treatment, and monitoring. The second contribution is sharing this robust end-to-end deep-learning pipeline for automated slice selection and body compartment segmentation on cross-sectional imaging.

What are the next steps?

We offer the software as an open-source AI tool that seamlessly integrates with platforms for image analysis and also disseminate it on the modelhub.ai platform. By making this algorithm publicly available, we hope to accelerate future studies in this domain and further facilitate the development of novel approaches for analyzing complex cancer imaging data sets.

This will allow further investigation of important associations established using BMI or manual CT-based body composition measurements. More broadly, advances in this research area will help guide the management of different cancers and improve our capacity for precision oncology.

More information: Tafadzwa L. Chaunzwa et al, Body Composition in Advanced Non-Small Cell Lung Cancer Treated With Immunotherapy, *JAMA Oncology* (2024). DOI: 10.1001/jamaoncol.2024.1120

Provided by Mass General Brigham