

Using Artificial Intelligence to prevent harm caused by immunotherapy

February 4 2021

Researchers at Case Western Reserve University, using artificial intelligence (AI) to analyze simple tissue scans, say they have discovered biomarkers that could tell doctors which lung cancer patients might actually get worse from immunotherapy.

Until recently, researchers and oncologists had placed these [lung cancer patients](#) into two broad categories: those who would benefit from immunotherapy, and those who likely would not.

But a third category—patients called hyper-progressors who would actually be harmed by immunotherapy, including a shortened lifespan after treatment—has begun to emerge, said Pranjal Vaidya, a Ph.D. student in [biomedical engineering](#) and researcher at the university's Center for Computational Imaging and Personalized Diagnostics (CCIPD).

"This is a significant subset of patients who should potentially avoid immunotherapy entirely," said Vaidya, first author on a 2020 paper announcing the findings in the *Journal for Immunotherapy of Cancer*. "Eventually, we would want this to be integrated into clinical settings, so that the doctors would have all the information needed to make the call for each individual patient."

Ongoing research into immunotherapy

Currently, only about 20% of all [cancer patients](#) will actually benefit

from immunotherapy, a treatment that differs from chemotherapy in that it uses drugs to help the immune system fight [cancer](#), while chemotherapy uses drugs to directly kill [cancer cells](#), according to the National Cancer Institute.

The CCIPD, led by Anant Madabhushi, Donnell Institute Professor of Biomedical Engineering, has become a global leader in the detection, diagnosis and characterization of various cancers and other diseases by meshing medical imaging, machine learning and AI.

This new work follows other recent research by CCIPD scientists which has demonstrated that AI and [machine learning](#) can be used to predict which [lung](#) cancer patients will benefit from immunotherapy.

In this and previous research, scientists from Case Western Reserve and Cleveland Clinic essentially teach computers to seek and identify patterns in CT scans taken when lung cancer is first diagnosed to reveal information that could have been useful if known before treatment.

And while many cancer patients have benefitted from immunotherapy, researchers are seeking a better way to identify who would mostly likely respond to those treatments.

"This is an important finding because it shows that radiomic patterns from routine CT scans are able to discern three kinds of response in lung cancer patients undergoing immunotherapy treatment—responders, non-responders and the hyper-progressors," said Madabhushi, senior author of the study.

"There are currently no validated biomarkers to distinguish this subset of high risk patients that not only don't benefit from immunotherapy but may in fact develop rapid acceleration of disease on treatment," said Pradnya Patil, MD, FACP, associate staff at Taussig Cancer Institute,

Cleveland Clinic, and study author.

"Analysis of radiomic features on pre-treatment routinely performed scans could provide a non-invasive means to identify these patients," Patil said. "This could prove to be an invaluable tool for treating clinicians while determining optimal systemic therapy for their patients with advanced non- small cell lung cancer."

Information outside the tumor

As with other previous cancer research at the CCIPD, scientists again found some of the most significant clues to which patients would be harmed by immunotherapy outside the tumor.

"We noticed the radiomic features outside the tumor were more predictive than those inside the tumor, and changes in the blood vessels surrounding the nodule were also more predictive," Vaidya said.

This most recent research was conducted with data collected from 109 patients with non-[small cell lung cancer](#) being treated with [immunotherapy](#), she said.

More information: Pranjal Vaidya et al, Novel, non-invasive imaging approach to identify patients with advanced non-small cell lung cancer at risk of hyperprogressive disease with immune checkpoint blockade, *Journal for ImmunoTherapy of Cancer* (2020). [DOI: 10.1136/jitc-2020-001343](#)

Provided by Case Western Reserve University

Citation: Using Artificial Intelligence to prevent harm caused by immunotherapy (2021,

February 4) retrieved 24 November 2023 from

<https://medicalxpress.com/news/2021-02-artificial-intelligence-immunotherapy.html>

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