New research shows the power of radiomics to improve precision medicine

August 3 2017

Precision medicine has become the leading innovation of cancer treatment. Patients are routinely treated with drugs that are designed to target specific tumors and molecules. Despite the progress that has been made in targeted cancer therapies, the path has been slow and scientists have a long road ahead. In a collaborative project, researchers at the Moffitt Cancer Center and Dana-Farber Cancer Institute investigated the emerging field of radiomics has the potential to improve precision medicine by non-invasively assessing the molecular and clinical characteristics of lung tumors. Their work was published in the July 21 issue of *eLIFE*, a novel, emerging journal in biomedicine founded by National Academy members and Nobel Prize winners.

Radiomics offers scientists and clinicians a novel way to analyze individual tumors for their biology, guide cancer treatment, and predict response to therapy. Virtually every cancer patient has their tumor imaged though computed tomography (CT), magnetic resonance (MRI), and/or positron emission tomography (PET) as standard-of-care. The images allow physicians to determine the stage and location of a tumor and guide treatment decisions. But with recent advances in computer generated data and models, these images are now being used in the field of radiomics to extract high-dimensional data that can be used to guide precision medicine. By using radiomics, scientists are able to objectively quantitate different features of tumors, such as intensity, shape, size and texture. These data can then be used in combination with genetic and clinical data to predict active biological pathways, clinical outcomes, and potential effective therapies.

"The core belief of radiomics is that images aren't pictures, they're data. We have to treat them as data. Right now, we extract about 1300 different quantitative features from any volume of interest," said Robert Gillies, Ph.D., chair of Moffitt's Department of Cancer Imaging and Metabolism.

This collaboration analyzed CT image features from 262 North American patients and 89 European patients with non-small cell lung cancer (NSCLC). They identified associations between the image features and molecular markers, biological pathways, and clinical outcomes. For example, they determined that certain sets of image features could predict the overall survival of NSCLC patients, while other image features could predict the stage of the tumor or the presence of biological and genetic markers that drive tumor growth. The researchers also demonstrated the clinical importance of radiomics by showing that it is possible to increase prognostic power by combining radiomic data with genetic information and clinical data.

"We already knew that radiomic algorithms have strong clinical importance; however, the biological basis for these observations remained unknown. This study now answers this key question for the first time by defining and independently validating the driving biological pathways of radiomic phenotypes" said Hugo Aerts, Ph.D., director of the Computational Imaging and Bioinformatics Laboratory and associate professor of Radiation Oncology at Harvard Medical School.

Radiomics has several advantages over other commonly used techniques that guide precision medicine. Currently, biological markers are routinely analyzed with tissue biopsies that are invasive, collected only at the beginning of care, and may not accurately reflect the biology of the entire tumor. In contrast, imaging techniques are noninvasive and can provide information about the entire tumor throughout the entire course of treatment and response. Additionally, the majority of cancer patients

routinely have images taken for diagnostic purposes already, making radiomics a cost-effective approach.

"This study advances the molecular knowledge of radiomic characterization of tumors, information currently not used clinically. This may provide opportunities to improve decision-support in all patients as imaging is routinely used in clinical practice as standard of care," said Gillies.

Provided by H. Lee Moffitt Cancer Center & Research Institute