

AI-Driven Biomarker Model May Improve Detection of Cancer Cachexia

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A multimodal, artificial intelligence (AI)-driven model that analyzes routinely collected imaging and clinical information led to more accurate prediction of cancer cachexia than standard methods, according to results presented at the [American Association for Cancer Research \(AACR\) Annual Meeting](#), held April 25-30.

“Cancer cachexia is a serious complication affecting many patients with cancer and is characterized by systemic inflammation, severe muscle wasting, and profound weight loss,” said Sabeen Ahmed, a graduate student at the University of South Florida and Moffitt Cancer Center.

“Detection of cancer cachexia enables lifestyle and pharmacological interventions that can help slow muscle wasting, improve metabolic function, and enhance the patient’s quality of life,” Ahmed noted. “Unfortunately, current methods for detecting cancer cachexia rely on clinical observations, weight loss thresholds, and indirect biomarkers, which are often inconsistent, subjective, and detected too late in disease progression.”

Ahmed and colleagues hypothesized that the detection of cancer cachexia might be improved with the use of an AI-driven biomarker, which Ahmed explained is an algorithmically derived indicator of cancer cachexia learned using machine learning. “Compared with traditional biomarkers, AI-driven biomarkers may enable more sensitive and accurate detection of cancer cachexia by uncovering complex patterns missed by traditional analyses,” she said.

In this study, the researchers developed and evaluated a multimodal, AI-driven multilayer perceptron model that integrates information from imaging scans and multiple types of routine clinical data to report an AI-driven biomarker—in this case, the probability that a patient has or will develop cancer cachexia.

When imaging was combined with information about patient demographics, weight, height, and cancer stage in patients with pancreatic cancer, the model accurately identified cachexia in 77% of cases. This accuracy increased to 81% with the addition of lab results and further to 85% when

structured clinical notes were incorporated.

The researchers also evaluated the ability of the multimodal AI-driven biomarker model to predict a patient's relative survival. Compared with standard methods relying on clinical data alone, the multimodal AI-driven survival analysis exhibited 6.7%, 3.0%, and 1.5% greater accuracy for patients with pancreatic, colorectal, and ovarian cancer, respectively.

The AI-driven biomarker model works through two main steps. First, it examines diagnostic images, such as computed tomography (CT) scans, to quantify the amount of skeletal muscle in the patient's body using an algorithm that automatically detects and measures muscle.

The model provides an estimate of how confident it is in the quantification, which helps flag low confidence results that are likely to deviate significantly from manual assessments, Ahmed explained, adding that this enables informed interpretation and potential human review.

Next, the model compiles multiple types of clinical data routinely collected as part of a cancer diagnosis workup—lab results, notes from electronic medical records, and weight and height measurements, among others—and incorporates these data with the skeletal muscle quantification from the first step to compute the AI-driven biomarker.

The model's skeletal muscle quantification function was trained using annotated CT scans from patients with gastroesophageal or pancreatic cancer and validated on a separate set of images from patients with pancreatic, colorectal, and ovarian cancer. In the validation test, the AI model's quantifications of skeletal muscle differed by a median of 2.48% from the manual quantifications made by expert radiologists.

"The median discrepancy of 2.48% indicates that, on average, the model's measurements of skeletal muscle were very close to the expert radiologists' measurements, demonstrating the high reliability of our AI-based approach," Ahmed explained.

"Our AI-driven multimodal approach provides a scalable and objective solution for detecting cancer cachexia using multiple types of data collected at the time of cancer diagnosis, potentially allowing health care providers to initiate interventions to mitigate cachexia earlier in the disease course," she noted. "The findings highlight the growing potential of machine learning to revolutionize cancer care and enable personalized treatment plans."

A limitation of the study was that the AI-driven model was trained and validated using data from only a few cancer types, which precludes understanding how the model would perform in patients with other cancers. Another limitation is that the study only used CT scans for skeletal muscle analyses; incorporating other types of imaging scans may improve the robustness of the model, Ahmed noted. She also explained that since the model's performance depends on the quality of the clinical and imaging data it analyzes, missing or noisy data may affect its accuracy in real-world clinical applications.

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