Fluidity predicts aggressiveness of cancerous tumors, study

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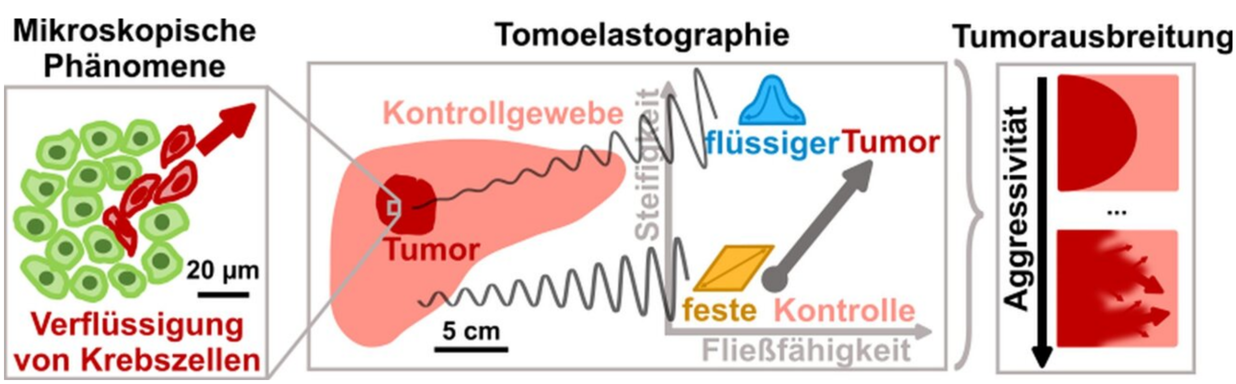

Tumour-associated microscopic effects such as the liquification or increased fluidity of cancer cells have an effect on the tumour's macroscopic mechanical properties. These can then be measured directly in a patient's body using tomoelastography. Credit: Frank Sauer, Leipzig University

Doctors have been palpating suspicious hardened areas under their patients' skin throughout recorded history. Scientists at Charité university clinic in Berlin and Leipzig University, in cooperation with clinical diagnostic radiologists and biophysicists, have now proven that this ancient diagnostic method continues to show promise for the future.

They discovered that a tumor's consistency can have a decisive influence on how a cancer progresses, and they recently published their findings in the journal *Advanced Science*.

The first step was for the Charité Experimental Radiology team under the direction of Prof. Ingolf Sack to develop a novel imaging technique, called tomoelastography. This allows scientists to map out the mechanical properties of tumors and surrounding tissue using an MRI.

After the radiologists had gathered a great deal of patient data on the changing stiffness and fluidity of cancerous tumors, Prof. Josef Käs' team of biophysicists at Leipzig University took a closer look at the tumors' micromechanics. Käs and his colleagues then compared the data from Charité with the fluid properties of individual cells and tumor sample explants, received from their collaborators from the University of Leipzig Medical Center. "We found surprisingly consistent patterns between the changes in the tumors' mechanical material properties and their increasing aggressiveness," Käs said.

Frank Sauer, the study's lead author and a member of Käs' team, explained that these mechanical patterns are more complicated than simply differentiating between stiff and soft tissue. While palpation findings tend to name one of these two possibilities, tomoelastography allows for an additional graduated measurement of the change from solid to fluid behavior with precision down to the pixel level. "If cells in the tissue trade places, like in running water, then that leads to the entire tumor having a higher degree of fluidity," stated Sauer.

In the past, Käs and his team were able to show that precisely these kinds of "cell rivers" exist in cancerous growths even if the tumor as a whole can be felt as a stiff lump.

Sack's team at Charité were now able to measure these fundamental links for the first time in patients and use the information for diagnostics. Sauer explained that the assessment of fluidity, hardness and texture of a lump using tomoelastography could enable more precise cancer diagnoses and thereby help patients receive tailored treatment options. The study is now to be evaluated in additional clinical pilot studies so that it can be used in radiological diagnostics.

More information: Frank Sauer et al, Changes in Tissue Fluidity Predict Tumor Aggressiveness In Vivo, *Advanced Science* (2023). DOI: 10.1002/advs.202303523

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