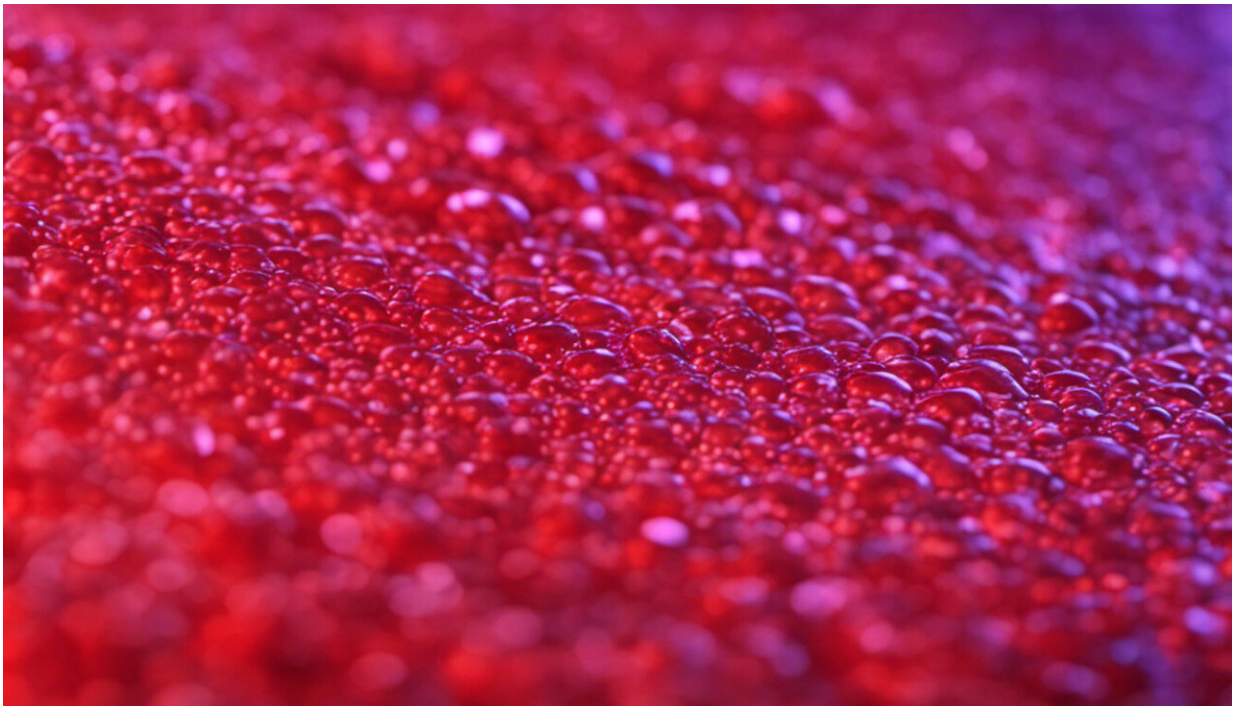
Blood-based tests to detect and monitor lung cancer

December 14 2021



Credit: AI-generated image (disclaimer)

To diagnose lung cancer, tumor tissue is collected from a patient and checked for signs of cancer. However, this is not always possible due to tumor location, and can be painful for the patient. For his Ph.D. research, Remco de Kock worked on a liquid biopsy approach based on the PCR method to search for tumor biomarkers in the blood of patients

suspected of having lung cancer. It's minimally invasive, patient friendly, and proves very effective. He defends his thesis on December 14th at the department of Biomedical Engineering.

Proper diagnosis of lung cancer relies on the collection of a lung tumor tissue biopsy, but this is not always possible and can be painful for the patient.

One way to skip this is the use of so-called liquid biopsies. Put simply, a blood sample from a patient is analyzed for biomarkers associated with tumors. For his Ph.D. research, Remco de Kock's studied the use of liquid biopsy in diagnosis and therapy monitoring of lung cancer patients.

Searching for tumor biomarkers

"With many diseases, it's all about finding evidence that the disease is in the body in the first place," says de Kock. "For lung tumors, the telltale sign is the presence of cell-free tumor DNA (ctDNA)."

ctDNA is a fraction of all of the cell-free DNA circulating in the blood from tumor cells. But there's a slight issue; for anyone with lung cancer, especially at the early stages of the disease, ctDNA is only present in tiny amounts, which means that very sensitive detection techniques are needed.

Validation and eliminating drawbacks

Before the assay could be used with patients, validation was necessary.

"We validated the ddPCR test with reference standards containing known concentrations of ctDNA," explains de Kock. "We also

developed a standards blueprint for sample collection, processing, and analysis, which are all needed when it comes to using the test in hospitals."

The ddPCR test then underwent clinical validation where it was applied to samples from patients strongly suspected of having lung cancer based on tissue mutation analysis, which is the gold standard. This ddPCR test is already implemented in Catharina Hospital in daily practice.

When it comes to therapy response monitoring, the gold standard is radiographic imaging, but a drawback is that it's only reliable after long time periods (two to three months). Conversely, analysis of ctDNA has the potential to inform after just a few weeks.

De Kock found excellent agreement between the course of ctDNA concentration in blood and the disease course in radiographic imaging. "From this, we highly recommend a new ctDNA approach based on repeated ctDNA testing to guide the frequency of radiographic imaging. In this way, disease progression could be detected earlier."

Turning to 'water on the lungs'

De Kock then assessed the flexibility of the ctDNA test by applying it to another liquid biopsy source—pleural effusion, also known as "water on the lungs." This is a build-up of excess fluid between the pleura, large sheets of tissue around the lungs.

"We are the first to show that pleural effusion can be used in therapy response monitoring," says De Kock. "We suggest that testing of pleural effusion and blood should be used to help guide therapy selection and monitor disease progression."

A little diagnosis help from algorithms

Of course, it's one thing to develop an effective test, it's another thing to properly evaluate the results of tests.

To help with diagnosis, three machine learning algorithms were trained with input data made up of test results from liquid biopsies using the ctDNA ddPCR approach and imaging information on the suspected tumor. Output from the algorithms include the probability of lung cancer being present and distinctions between different types of lung cancer.

"By using the algorithms in clinical practice, diagnosis can become more objective and allow the medical practitioner to use most, it not all, of the data when making their diagnosis," notes de Kock.

And there are several benefits of using liquid biopsies for the doctor and the patient. "This test can be useful in cases where diagnosis is inconclusive or when the patient is too ill to have tissue biopsy surgery. Thanks to the models and this minimally invasive test, patients might receive an accurate diagnosis earlier and also avoid the need to have tissue biopsies collected via surgery."

Provided by Eindhoven University of Technology

Citation: Blood-based tests to detect and monitor lung cancer (2021, December 14) retrieved 1 February 2024 from https://medicalxpress.com/news/2021-12-blood-based-lung-cancer.html