Cancer biomarkers: Making possible early detection, diagnosis and treatment of cancer in unimaginable ways

Ten years ago, it would have seemed nearly impossible to screen a single drop of blood and detect cancer in less than an hour. Last month this became a reality. Researchers announced a major breakthrough in oncology: they developed a test that could confirm the presence of pancreatic cancer in minutes by just analyzing a person's blood. The test analyzed and identified specific genetic material in the blood, also known as a 'biomarker', that pointed to the presence of pancreatic cancer cells.

Biomarkers by themselves are not a new discovery; they have been used by scientists and doctors for decades to diagnose diseases. Examples of widely used biomarkers include cholesterol levels for heart disease, C-reactive protein (CRP) levels for inflammation, and changes in brain electrical activity to diagnose neurological disorders. An ideal biomarker is safe to isolate and easy to measure; cost-effective to track; modifiable with treatment; and consistent and stable across gender and ethnic groups.

Biomarkers in cancer: the clues to a complex puzzle

The complexities of cancer remain a mystery that science has yet to untangle. This is why every new piece of evidence adds to our bank of solutions. In recent years, we have had success in identifying several potential biomarkers for the presence, development and progression of cancer. These include proteins, biochemicals and genetic changes (mutations) to DNA and RNA in cancer cells. A cancer biomarker is specific to a given type of cancer and not normally present in the cells and tissues of healthy individuals. If we can thoroughly process detect cancers early we can save many more lives.

The four big roles of cancer biomarkers

To determine risk: Mutations in certain genes that control and prevent cancer development are one of the first indicators of potential disease. For example, people with mutations in the BRCA 1 and 2 genes are at a higher risk of developing breast cancer. Identifying these biomarkers can help physicians determine a person’s risk for the disease and recommend more frequent screenings to catch the cancer at an early stage. Early detection means a far better prognosis and possibly a full cure.

To diagnose more accurately: In patients who develop cancer, the body often responds by releasing immune agents (such as antibodies), by shedding certain proteins in the blood, or by shedding mutated DNA fragments in the circulatory system. Screening for these biomarkers through different biological sampling methods acts as a real-time indicator of the presence of cancer, its type and the extent of its spread in the body. Cancer as a disease has the supreme capacity to hide its presence and show itself only after it has taken a strong hold on our bodies. Biomarkers can now help us diagnose it sooner and more accurately for treatment to be right the very first time.

To predict response to treatment: Certain mutations that they make these cells resistant and unresponsive to cancer medicines. Some lung cancer patients, for example, develop resistance to first line medicines because of a mutation called T790M. Researchers identified this mutation as a lung cancer biomarker only recently and now we have a drug to specifically target this mutation, making it possible to treat this type of lung cancer. Identifying such biomarkers helps oncologists understand why a certain treatment fails and how to alter treatment for patients with these biomarkers.

To evaluate chance of cancer recurrence: At one time we had no way of knowing whether a cancer would recur and if so where. Now we do have a way of doing this at least for breast cancer. The 21-gene recurrence score is a prognostic cancer biomarker in a specific type of cancer called node-negative, tamoxifen-treated breast cancer that can predict breast cancer recurrence and overall survival. Another valuable cancer biomarker is a protein called HE4 (Human epididymis protein 4), which if present at a high level in a patient's blood helps to predict the recurrence of ovarian and endometrial cancers. So far cancer recurrence has been one of the biggest challenges in saving lives from cancer. Now we see a small light at the end of this dark tunnel!

For the future: research and more research

More often than not, scientists discover biomarkers by accident, changing upon abnormal substances or traits in patients with cancer that are not present in healthy individuals. These discoveries always require much more investigation, to check for reliability and new easy it is to isolate and monitor them during treatment. For this reason, we have been able to identify only a few biomarkers in the last 20 years. But the search goes on and I look forward to a day when we can use biomarkers for all known cancers that are otherwise only detected in their advanced stages.

References:


