Journal of Cancer Research and Immuno-Oncology

OPEN ACCESS Freely available online

Commentary

Targeted Diagnostics: Transforming Cancer Treatment with Personalized Therapeutic Approaches

Bernard Limor*

Department of Urology, Amsterdam University, Amsterdam, The Netherlands

DESCRIPTION

The field of oncology has perceived significant advancements in the last few decades, with biomarkers and companion diagnostics playing an increasingly pivotal role in cancer treatment. As medicine moves towards a more personalized approach, these tools are essential for adapting treatments to the individual characteristics of each patient's cancer, thus optimizing therapeutic outcomes and minimizing adverse effects. This essay provides a comprehensive overview of biomarkers and companion diagnostics, their significance in cancer care, the different types, their clinical applications, and the challenges and future directions in this rapidly evolving field.

Understanding biomarkers

Biomarkers are measurable indicators of a biological state or condition. In the context of cancer, they are substances, structures, or processes that can be measured in the body and predict the risk, presence, or progression of cancer, as well as responses to treatments. Biomarkers may be molecules such as proteins, genes, or specific cell types.

The National Institutes of Health (NIH) defines a biomarker as a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes, or pharmacologic responses to a therapeutic intervention. Biomarkers are important in oncology because they help in understanding the biology of cancer, which enables the development of targeted therapies and informs treatment decisions.

Categories of biomarkers

Biomarkers can be classified into various categories based on their role in disease and treatment.

Diagnostic biomarkers: These biomarkers are used to detect or confirm the presence of cancer. They are particularly useful in early detection and in distinguishing between cancerous and non-cancerous conditions. For instance, Prostate-Specific Antigen (PSA) is a well-known diagnostic biomarker used in screening for prostate cancer.

Prognostic biomarkers: These biomarkers provide information about the likely course of the disease in the absence of treatment. They can help predict disease outcomes, such as recurrence or progression, independent of treatment. An example is the expression of Estrogen Receptors (ER) in breast cancer, which helps predict the likelihood of recurrence.

Predictive biomarkers: Predictive biomarkers are used to determine whether a patient is likely to benefit from a particular treatment. They help guide the selection of therapies that are most likely to be effective. One prominent example is the presence of mutations in the Epidermal Growth Factor Receptor (*EGFR*) gene in Non-Small Cell Lung Cancer (NSCLC), which predicts the response to EGFR inhibitors such as erlotinib.

Pharmacodynamic biomarkers: These biomarkers provide real-time feedback on the effect of a treatment on the cancer or its environment. They help assess whether the therapy is having its intended biological effect. An example is the use of circulating tumor DNA (ctDNA) to monitor the effectiveness of therapies.

Prognostic-predictive biomarkers: Some biomarkers serve both prognostic and predictive functions. For instance, Human Epidermal Growth Factor Receptor 2 (HER2) in breast cancer can indicate a poor prognosis but also predict responsiveness to HER2-targeted therapies like trastuzumab.

Biomarkers in personalized cancer therapy

Personalized cancer therapy, also known as precision oncology, relies heavily on biomarkers to personalize treatment to individual patients. This approach contrasts with the traditional one-size-fits-all model, where treatment decisions are based primarily on the tumor type and stage, with little consideration for individual molecular variations.

Targeted therapies: Many cancer therapies target specific molecules or pathways that are aberrantly activated in cancer cells. Biomarkers play a key role in identifying patients who are

Correspondence To: Bernard Limor, Department of Urology, Amsterdam University, Amsterdam, The Netherlands, E-mail: Blimor@amsterdamumc.nl

Received: 19-Aug-2024, Manuscript No. JCRIO-24-34297; **Editor assigned:** 21-Aug-2024, PreQC No. JCRIO-24-34297 (PQ); **Reviewed:** 04-Sep-2024, QC No. JCRIO-24-34297; **Revised:** 11-Sep-2024, Manuscript No. JCRIO-24-34297 (R); **Published:** 18-Sep-2024, DOI: 10.35248/2684-1266.24.10.230

Citation: Limor B (2024). Targeted Diagnostics: Transforming Cancer Treatment with Personalized Therapeutic Approaches. J Can Immunooncol. 10:230.

likely to benefit from such therapies. For instance, patients with breast cancer whose tumors overexpress HER2 benefit from HER2-targeted therapies like trastuzumab. Similarly, BRAF mutations in melanoma can guide the use of BRAF inhibitors such as vemurafenib.

Immunotherapy: Biomarkers are also used to predict response to immunotherapy. For example, the expression of Programmed Death-Ligand 1 (PD-L1) on tumor cells or immune cells can predict the response to PD-1/PD-L1 checkpoint inhibitors like pembrolizumab and nivolumab. In some cases, the Tumor Mutational Burden (TMB) is also used as a biomarker to predict the efficacy of immunotherapy.

Resistance to therapy: Biomarkers are need for understanding resistance mechanisms to therapy. For instance, the development of resistance to EGFR inhibitors in lung cancer patients often involves mutations in the *T790M* gene, and this can be detected using biomarkers, enabling the use of second-line therapies like osimertinib.