**Biomarkers and Immune Checkpoints in Cancer**

**Introduction**

Immune checkpoints are regulatory pathways that either stimulate or inhibit immune responses. With the emergence of evasion of cancer cells from immune checkpoints as an important hallmark of cancer, researchers have placed more focus on the role of immunotherapy in cancer treatment (George *et al.*,2019). The discovery of biomarkers associated with these immune checkpoints improves the efficacy of immunotherapies. This essay explores how discovering biomarkers can help enhance patient selection, monitoring of treatments and response to therapies.

**Biomarkers and immune checkpoints**

Biomarkers are biological molecules that signify the onset and progression of a disease. They help predict the best course of treatment and a patient’s response to it. In relation to immune checkpoints, biomarkers are genes or molecules associated with immune response to cancer cells. For example, the expression levels of Programmed Death-Ligand 1 (PD-L1) on healthy and malignant cells in a tumour microenvironment is used to predict a patient’s response to PD-1/PD-L1 inhibitors. Identifying and understanding these biomarkers can be used to predict which patients would mostly benefit from treatment using immune checkpoint inhibitors (ICIs), thus improving ICI’s efficacy and making treatment strategies more personalized (Bai *et al.*, 2020).

**Applications in Patient Selection and Stratification**

Patients’ response can vary to immunotherapies, but by using biomarkers, patients with favourable response can be identified, thereby improving patients’ survival (Zou and Wang, 2019). For instance, increased PD-L1 expression in tumor cells have been associated with better response to ICI therapies such as anti PD-1/PD-L1 (George *et al.*, 2019). In addition, Le, *et al* reported that Mismatch Repair Deficiency (MMRD) could be a predictive marker indicating positive response to anti-PD-1 therapy in patients with hereditary non-polyposis colorectal cancer (Le *et al.*, 2015). Therefore, by using these biomarkers to stratify patients based on their response to certain treatments, clinicians can improve treatment results and also decrease exposure to ineffective therapies.

**Monitoring Treatment Response and Resistance**

Biomarkers are used to monitor patients’ response and understand resistance mechanisms in immunotherapy. They help assess the effectiveness of ICIs in real time, so required adjustments can be made to treatment plans. For instance, a high number of mutations found in circulating tumor DNA (ctDNA) was linked to poor prognosis and increased overall survival in patients with various cancer types receiving ICI therapy (Bai *et al.*, 2020).

**Conclusion**

Biomarker discovery is a powerful tool that greatly improves the efficacy of ICIs therapy. The identification and validation of biomarkers linked to immunological checkpoints can help oncologists improve patient selection, monitor treatment effectiveness and develop strategies to overcome resistance. With a gradually improving knowledge of the tumour microenvironment, the discovery of new biomarkers will be essential in advancing personalized cancer therapy and improving patient outcomes.

**References**

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