Cancer and immunotherapy

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ABSTRACT

Cancer immunotherapy has revolutionized oncology by leveraging the body's immune system to target and eliminate cancer cells. Among the most successful immunotherapies are immune checkpoint inhibitors, particularly anti-CTLA-4 and anti-PD-1/L1 agents. Their efficacy has been demonstrated across a broad spectrum of cancer subtypes. The landscape of cancer immunotherapy continues to expand rapidly beyond the currently approved agents. Innovations such as bispecific immune checkpoint inhibitors, CAR T-cell therapies, cancer vaccines, and bispecific T-cell engagers are under intense investigation. In particular, the development of next-generation checkpoint inhibitors and combinatorial strategies—pairing immunotherapy with another immunotherapy, targeted therapy, chemotherapy, or radiation—holds promise for overcoming resistance mechanisms and enhancing efficacy. Despite the remarkable progress, significant challenges remain, particularly in identifying reliable predictive biomarkers for immunotherapy response. Currently utilized biomarkers, such as PD-L1 expression, tumor mutational burden, and microsatellite instability, have limitations in sensitivity and specificity. Ongoing research aims to uncover more robust biomarkers to better stratify patients who are most likely to benefit from immunotherapy. While immunotherapies have transformed cancer treatment outcomes, they are also associated with unique adverse events known as immune-related toxicities. These toxicities can affect any organ system. Early recognition and a multidisciplinary management approach are critical to effectively manage these adverse events. Essentially, immunotherapies are undeniably transformative anti-cancer treatments that have significantly improved overall survival and quality of life for many cancer patients. Continued multidisciplinary collaboration, innovative clinical trials, and patient-centric approaches will be pivotal in advancing this revolutionary field.

Keywords: Immune checkpoints inhibitor, predictive biomarker, immune related side effects, microbiome, tumor microenvironment