Unraveling the immunological mechanisms driving the success of cancer immunotherapy.

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Introduction

Recently, cancer immunotherapy has become standard for cancer treatment. Immunotherapy not only treats primary tumors, but also prevents metastasis and recurrence, representing a major advantage over conventional cancer treatments. However, existing cancer immunotherapies have limited clinical benefits because cancer antigens are often not effectively delivered to immune cells. Furthermore, unlike lymphoma, solid tumors evade anti-cancer immunity by forming an immune-suppressive tumor microenvironment (TME). One approach for overcoming these limitations of cancer immunotherapy involves nanoparticles based on biomaterials. Here, we review in detail recent trends in the use of nanoparticles in cancer immunotherapy. First, to illustrate the unmet needs for nanoparticles in this field, we describe the mechanisms underlying cancer immunotherapy. We then explain the role of nanoparticles in the delivery of cancer antigens and adjuvants. Next, we discuss how nanoparticles can be helpful within the immune-suppressive TME. Finally, we summarize current and future uses of nanoparticles with image-guided interventional techniques in cancer immunotherapy [1, 2].

Immunotherapy has emerged as a major therapeutic modality in oncology. Currently, however, the majority of patients with cancer do not derive benefit from these treatments. Vascular abnormalities are a hallmark of most solid tumours and facilitate immune evasion. These abnormalities stem from elevated levels of proangiogenic factors, such as VEGF and angiopoietin 2 (ANG2); judicious use of drugs targeting these molecules can improve therapeutic responsiveness, partially owing to normalization of the abnormal tumour vasculature that can, in turn, increase the infiltration of immune effector cells into tumours and convert the intrinsically immunosuppressive Tumour Microenvironment (TME) to an immunosupportive one. Immunotherapy relies on the accumulation and activity of immune effector cells within the TME, and immune responses and vascular normalization seem to be reciprocally regulated. Thus, combining antiangiogenic therapies and immunotherapies might increase the effectiveness of immunotherapy and diminish the risk of immune-related adverse effects. In this Perspective, we outline the roles of VEGF and ANG2 in tumour immune evasion and progression, and discuss the evidence indicating that antiangiogenic agents can normalize the TME. We also suggest ways that antiangiogenic agents can be combined with immune-checkpoint inhibitors to potentially improve patient outcomes, and highlight avenues of future research [3].

The recent clinical successes of immune checkpoint blockade and chimeric antigen receptor T cell therapies represent a turning point in cancer immunotherapy. These successes also underscore the importance of understanding basic tumor immunology for successful clinical translation in treating patients with cancer. The Reviews in this Review Series focus on current developments in cancer immunotherapy, highlight recent advances in our understanding of basic aspects of tumor immunology, and suggest how these insights can lead to the development of new immunotherapeutic strategies [4, 5].

Conclusion

The concept that the immune system can recognize and control tumor growth can be traced back to when William Coley used live bacteria as an immune stimulant to treat cancer, but the enthusiasm for cancer immunotherapy has been moderate due to limited clinical efficacy. This limited efficacy is due to the ability of tumor cells to avoid recognition and elimination by the immune system, allowing them to become established in the host . Over the past few decades, tremendous progress has been made in the understanding of how cancer evades the immune system, which in turn offers new ways to stop cancer immune evasion in favour of eliminating cancer cells.

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