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Short Communication

Advancements of Therapeutic Vaccine in Cancer Treatment

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DESCRIPTION

The rapid advancement of nano-biotechnology has allowed for advancements in therapeutic cancer vaccines. These vaccines use tumor antigens to stimulate the host's innate immune response, which leads to a cascading adaptive response against cancer [1]. However, due to the vaccine's poor clinical performance in tumor inhibition and regression, an improved anti-tumor immune response is still in high demand. To date, the most significant barriers to therapeutic cancer vaccines have been a complex tumor immunosuppressive environment and suboptimal design. It is critical for therapeutic cancer vaccines to optimize tumor antigens, vaccine delivery pathways, and appropriate adjuvants for innate immune response initiation, as well as reprogramming the tumor immunosuppressive environment, in order to elicit an adequate antitumor immune response [2]. Cancer treatment vaccines are a type of immunotherapy that treats cancer by boosting the body's natural anti-cancer defenses. Cancer treatment vaccines, as opposed to cancer prevention vaccines, are intended for use in people who already have cancer; they work against cancer cells rather than something that causes cancer.

The idea behind treatment vaccines is that cancer cells contain substances known as tumor-associated antigens that are not found in normal cells or are present at low levels. Treatment vaccines can teach the immune system to recognize and respond to these antigens, allowing cancer cells to be destroyed. Prophylactic Human Papilloma Virus (HPV) cancer vaccines and therapeutic vaccines are intended for cancer treatment. While the prophylactic HPV vaccination aims at the induction of virus-specific antibodies, therapeutic immunization aims at inducing tumor-specific adaptive immune responses. Preclinical studies have shown that the therapeutic efficacy of most therapeutic cancer vaccines is lower than expected. This limited clinical response may be due, among other things, to insufficient or inappropriate activation of antigen-specific immune effector cells in cancer patients as a result of immune tolerance or immune suppression. The immune suppressive tumor microenvironment. Limited homing and accumulation of immune effector cells into the tumor and limitations due to narrow-spectrum and highly specific adaptive immune responses that do not target the entire tumors [3].

To create a vector for therapeutic vaccination, it must be engineered to be both safe and effective. As a result, vector design is as important to vaccine development as epitope screening and understanding of the target disease. It is now possible to engineer DNA-based, RNA-based, bacterial chassis, and viral vectors for safe and effective immunization advances in synthetic biology. Each vector design is intended to bring together genetic components and their respective resources to function, including but not limited to antigen transcription-translation, appropriate presentation, and target immune cell activation [4]. Listeria monocytogenes, a genetically modified bacterial chassis that has shown promising therapeutic benefits in pre-clinical models and is currently being tested in clinical trials for anti-cancer therapy attenuated listeria strains have been created by deleting or replacing virulence genes or by photo-chemically inactivating the bacterial vectors. These attenuation strategies outperform heat-kill inactivation because they allow the vector to invade host cells and secrete target antigens in the cytosol for antigen presentation, inducing CD8+ T-cell responses. Additionally, antigen-mediated antitumor immune responses can be enhanced *via* fusion with Listeria antigens, resulting in a stronger antitumor immune response [5]. To re-stimulate antigen-specific immunity, future research appears to focus on combining vaccines with radiotherapy or chemotherapy, checkpoint blockade, or possibly a heterologous boost of vaccination with viral vectors.

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