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Commentary

Recent Advances and Developments of Nanomedicines for Cancer Therapy

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DESCRIPTION

The detection and treatment of illnesses have advanced in nanomedicine in an unheard-of way during the past ten years. Numerous nanomedicines have received clinical approval, proving the potential benefit of moving medications changed by nanotechnology from the lab to the patient's bedside. By enabling the collection and analysis of massive datasets and the creation of precision nanomedicines for cancer treatment, the use of Artificial Intelligence (AI) in the production of nanotechnology-based product has the potential to revolutionize the healthcare industry. By adjusting the characteristics of nanomedicines, achieving efficient drug synergy, and reducing nanotoxicity, AI-enabled nanotechnology could enhance the accuracy of single - molecule profiling and early patient diagnosis as well as optimize the design pipeline of nanomedicines, improving their targetability, personalized dosing, and therapeutic potency.

The creation of nanomedicines to treat many diseases, including cancer, has advanced significantly as a result of the widespread adoption of nanotechnology in the medical industry. Numerous cancer nanomedicines have so far shown promise in preclinical research by enhancing therapy results, extending survival, and/or reducing adverse effects. The transition from bench to bedside is still difficult, though. Although several nanomedicines have begun clinical testing, only a small number have been given the go-ahead for use in patients. By changing the drug's bio distribution, nanoparticle carriers can enhance the effectiveness of antibiotics. Traditional screening, however, is impractical because of a vast data space. To uncover polymer, antibiotic, and particle determinants of antibacterial nanomedicine efficacy against *Burkholderia cepacia* and to predict nanomedicine performance, a hybrid informatics technique was established. High correlations were found between antimicrobial effectiveness and the polymer glass transition temperature, drug octanol-water partition coefficient, strongest acid dissociation constant, physiological charge, particle diameter, count and mass mean polydispersity index, zeta potential, fraction drug released at 3 hours, and fraction release slope at 3 hours. In order to accurately simulate the performance of nanomedicine, dimensionality had to be reduced while nonlinear descriptor-property connections were preserved. The model accurately predicted particle behaviour in holdout validation and had a fair degree of rank-ordering precision.

Due to their distinct benefits, nanomedicines have been considered as a promising strategy in the field of cancer treatment. Although therapeutic efficacy can be increased, the severe side effects brought on by unintentional retention of therapeutic molecules in healthy tissues still restrict the applicability of the majority of classical nanomedicines. Nanomedicines that realize drug release in response to external or endogenous stimuli have been created as stimuli-responsive nanomedicines, which enhance the controllability of therapeutic agent accumulation in targeted areas (such as tumors). These stimuli-responsive nanomedicines exhibit inadequate selectivity and specificity since the majority of them are triggered by a single type of stimulus. Contrarily, or dual and multi-responsive nanomedicines can release drugs more safely and effectively, resulting in increased therapeutic efficacy and less systemic toxicity. These nanomedicines incorporate many response components into a signal Nano platform. Here, we review current developments in dual- and multi-responsive nanomedicines-based precision cancer treatment. These dual-and multi-responsive nanomedicines' design principles, functional principles, and uses in chemotherapy, phototherapy, and immunotherapy of cancer are discussed in depth.

CONCLUSION

Although immunotherapy has been used effectively to treat a variety of cancer types, there are still numerous obstacles standing in its way when it comes to PC. A particularly aggressive malignant kind of cancer is Pancreatic Cancer (PC). As a result, nanomedicines were developed to improve PC cells' receptivity to Immune Checkpoint Inhibitors (ICIs). In order to improve the infiltration of Cytotoxic T Lymphocytes (CTLs), nanomedicines were employed to enhance the antibody responses of PC cells, inactivate stromal Cancer-Associated Fibroblasts (CAFs), improve the antigen-presenting capacity of Dendritic Cells (DCs), and reverse the Tumor Micro Environment's (TME) highly immunosuppressive nature. These actions led to effective antitumor immune responses.

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