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Commentary

A Short Note on Tumor Microenvironment and Drug Delivery

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DESCRIPTION

Cancer drug delivery has gotten a lot of attention lately. Several drug delivery systems are currently available in the market, and many more promising candidates are being developed. However, the complex tumor microenvironment has a significant impact on the drug delivery efficiency of these systems to tumors, while the tumor microenvironment can be used to design smart drug delivery systems for improving tumor drug delivery. As a result, understanding the tumor microenvironment and its impact on tumor drug delivery is critical for improving drug delivery efficiency to tumors.

There are several original studies in the area of tumor microenvironment and drug delivery. Tumor microenvironment features include dense stroma, irregular vascular structure, and numerous supporting cells such as Tumor Associated Macrophage (TAM) and cancer-associated fibroblasts. TAM is important in the tumor microenvironment. Discussed the complex role of macrophages in tumors, and then summarized potential macrophage-focused therapeutic strategies on desmoplastic tumors containing an abundance of stromal cells and extracellular matrix. They investigated the most recent advancements in natural products that inhibit desmoplastic tumors by modeling CAF and highlighted their potential therapeutic capabilities for cancer treatment.

The function of tumor vasculature and immune-vascular crosstalk in tumors they then proposed strategies for tumor vascular normalization. The tumor microenvironment is characterized by hypoxia and high levels of hydrogen peroxide (H_2O_2), which are significant barriers to cancer therapy. Catalase, an antioxidant enzyme, promotes the degradation of endogenous H_2O_2 and, as a result, tumor reoxygenation. The researchers created a deep-penetrated nanocatalase by coating catalase nanoparticles with a PEGylated phospholipids membrane, with the goal of alleviating tumor hypoxia and promoting chemo-photodynamic therapy. Based on excessive hydrogen peroxide in the tumor microenvironment and acidic microenvironment, we present a coreshell dual metal organic frameworks system loaded with photosensitizer indocyanine green and chemotherapeutic agent doxorubicin for photothermal/photodynamic/chemotherapy.

Despite recent exciting advances in cancer therapy, the complicated immunosuppressive tumor microenvironment continues to impede the clinical success of currently available immunotherapy. In this regard, highlighted the current understanding of the immunosuppressive tumor microenvironment and reviewed emerging nanotechnology-related strategies to modulate the immunosuppressive cells within the tumor immune microenvironment for robust immunotherapeutic responses. The main components of the biological and immunological microenvironments in tumors, as well as recent advances in nanoparticle drug delivery systems to targets within the tumor microenvironment to improve cancer chemotherapy and immunotherapy.

Centered on the relapse of acute myeloid leukemia (ALL) after allogeneic Hematopoietic Stem Cell Transplantation (allo-HSCT). They investigated currently available and promising upcoming agents targeting leukemia cells and the immune microenvironment for the prevention and treatment of ALL relapse after allo-HSCT therapy. Primary bile acids have the potential to activate natural killer T cell-based immunotherapy for liver cancer, but their use is limited by the widespread expression of receptors in the gastrointestinal tract. Developed Nano emulsion-loaded obeticholic acid for precisely manipulating liver sinusoidal endothelial cells and activating natural killer T cell mediated cancer immunotherapy. As a result the Nano emulsion successfully inhibited hepatic tumor growth and increased natural killer T cell populations within the tumor.

One of the most common causes of death is metastasis. This section first summarizes the targeting delivery strategies, which include primary tumor targeting drug delivery, tumor metastasis targeting drug delivery, and hijacking circulation cells. The application of immunotherapy in tumor metastasis treatment is then introduced as a promising treatment, and strategies that stimulate immune response, such as chemotherapy, photo thermal therapy, photodynamic therapy, ferroptosis, sonodynamic therapy, and Nano vaccines, are studied.

CONCLUSION

The microenvironment of tumor cells influences the binding of ligand modified nanoparticles. Fluidic shear stress, which exists

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in blood circulation, could be a critical factor in tumor cell binding. Developed dual-targeting Nano vesicles with varying v3-binding rates in order to achieve a "fast-binding/slow-unbinding" function both static and dynamic tumor cells were efficiently absorbed by the dual-targeting Nano vesicles, resulting in an antitumor effect. Drug-loaded dual-targeting vesicles outperformed single-targeting vesicles in tumor metastasis and leukemia mice models. developed a locally injectable thermo-sensitive hydrogel based on poly (N-isopropylacrylamide-co-acrylic acid)-g-F68 copolymer to continuously release a Chinese medicine, triptolide, over time and kill cancer cells *via* a "two-strike" effect Antibody conjugation to drug carriers allows for specific cancer targeting; however, antigen recognition is required.