Emerging advances of nanomedicine in cancer therapy.

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Abstract

Cancer has become a major cause for deaths around the world, affecting over 10 million new patients every year. At present various treatment methods for cancer includes surgical resection, radiation, and chemotherapy. Although more than 90 chemotherapeutic drugs have been approved by the FDA for therapeutic use, their safety and efficacy has been severely reduced by dose-limiting toxicity and patient morbidity. The common materials used as nanocarriers in nanomedicines for cancer therapy includes polymers, biological nanomaterials, inorganic nanomaterials, liposomes, hydrogels, hybrid nanomaterials and micelles. Compared to conventional therapy, nanotherapeutic drug delivery systems have several potential advantages for cancer therapy, including higher payload capacity, prolonged blood circulation times, reduced toxicity to healthy tissues, and improved anti-tumor efficacy.

Keywords: Nanoparticles, Drug delivery, Cancer treatment, controlled release.

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Introduction

As per the International Union of Pure and Applied Chemistry (IUPAC), particle of any shape with dimensions within the 1–100nm range are defined as Nanoparticles. Despite this size restriction, the term nanoparticles commonly apply to structures that are up to several hundred nanometers in size.[1]

Advancements In Cancer Treatment Through Nano Carriers

Targeting

Active targeting: Active targeting nanoparticles possess several advantages in cancer therapy including enhancement of selectivity of drugs to cancer cells to avoid side effects to normal cells, enhancement of drug accumulation and anticancer activity in cancer cells, and efficiency in control of drug release.[2]

Passive targeting: The approach of passive drug targeting has been the most explored, and much preclinical learning. Passive targeting in accordance with the abnormality of tumor vasculatures, allowing nanoparticles the right of entry to tumors while avoiding distribution into healthy tissues.[3]

Stimuli-responsive systems/triggered release: Stimuli-responsive systems act in response to physical, chemical, or biological triggers that promote release of drugs by interfering with the phase, structure, or conformation of the nanocarrier. [3]

Controlled release

pH-responsive controlled release: Owing to the Warburg effect and impaired drainage, protons (H+ ions) heap up in tumors. Correspondingly, the pH of tumor microenvironment is extensively lower than that of normal tissues.[4]

Hypoxia-responsive controlled release: Hypoxia is one of the hallmarks of tumor due to the uncontrolled growth that utilizes a large amount of oxygen. It has been noted that the partial pressure of oxygen in tumor is only 40% of that in neighboring normal tissues.[4]

Enzyme-responsive controlled release: Cancer cells to maintain their unconstrained metabolism, repeatedly regulate the expression of few enzymes that are crucial for tumor growth and metastasis.[4]

Thermoresponsive controlled release: Thermoresponsive nanomedicines have been widely studied for cancer therapy, which now been extensively used by many researchers and therapist for various cancer treatments like liver cancer.[4]

Multiresponsive controlled release: The application of multiresponsive nanomedicines is the improved specificity that arises from the presence of two or more stimuli. Several multiresponsive nanomedicines for cancer therapy have been developed, considering the feasibility of this attractive approach.[4]

Multi-functionality/theranostics

Nanomedicines for combination therapy: Nanomedicine

allows novel solutions for cancer therapy. Nanomedicine could attack specific cells for chemotherapy. They possess the potential to enhance tumor control and minimize treatment side effects by improving the pharmacokinetics as well as tumor deposition of the drug overloads.[5]

Theranostic nanomedicines: Theranostic nanomedicine is now the new era of therapeutics in cancer. Nanoparticles carry entire units of active therapeutic ingredients with high affinity and compatibility that could be used in molecular imaging and for therapeutic purposes.[5]

Conclusion

The Journal will publish original articles, reviews, technical notes, editorials, news, and views (commentaries, science policy issues, ethical and legal issues, patient organizations, industry needs and alliances, regulatory issues, etc.), and letters to the editor. I thank all reviewers for their excellent contributions. At this stage we are calling for submissions of articles, commentaries, and letters to the editor for the upcoming issues. Reviews are by invitation only. We glance forward to receiving your exciting contribution. Finally, I would like to thank you, the contributors and readers for your interest in the journal and I encourage you to continue to send us your valuable feedback and ideas for further improvement of our journal.

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