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Enhancing the Utilisation of Nano-Pharmaceuticals

Boon Mian Teo*
Department of Chemistry, Monash University, Clayton, Australia

INTRODUCTION

One of the leading causes of mortality in the globe is cancer. Due to the non-specific systemic bio-distribution of anticancer drugs, cancer therapy is now far from ideal, despite advancements in traditional therapeutic alternatives. The insufficient medication concentrations at the tumour site contributed to a rise in the occurrence of multiple drug resistance as well as the emergence of several serious adverse side effects. Through the creation of medicines based on the nanoscale, nanotechnology offers the potential to offer brand-new, cutting-edge medications to get around these restrictions. In this article, we give a general overview of the authorised nano-medicine for the treatment of cancer as well as the justification for their creation and use. The potential and difficulties for nano-pharmaceuticals are also highlighted, with an emphasis on the tumour microenvironment and tumour disseminated cells as the most alluring and successful ways for cancer treatment [1].

According to the definition provided by the European Commission, nanoparticles (NPs) are materials in which at least half of the particles are equal to or smaller than 100 nm. Nanoparticles (NPs) are defined as solid particles in the size range 10-1000 nm. They frequently display novel and distinctive electrical, optical, magnetic, biological, and chemical features as well. Additionally, nanoparticles may be created from a variety of substances, such as composite polymers, semiconductors, metals, or even lipids and proteins. They can also have a variety of forms, such as spheres, rods, or tubes. There is rising interest in using nanoparticles to create new materials with uncommon and unexpected characteristics because of their variety of properties [2].

DESCRIPTION

The science of nanoscale, or the scale of nanometers or one billionth of a metre, is known as nanotechnology. A wide range of technologies, materials, and production techniques, including nanotechnology, are utilised to create and/or improve a variety of products, including pharmaceuticals. In recent years, this technology has made significant advancements in the field of cancer. The majority of chemotherapeutic medicines do not target only cancer cells, but also healthy cells, which might have a variety of negative consequences. It is not practical to provide huge amounts that can damage healthy cells because of its non-specific targeting. Additionally, modest dosages can make cancer cells resistant, making them difficult to destroy.

Understanding the intricacy of nanotechnology holds the key to a potential solution that might improve medicine targeting and distribution. The detection and treatment of cancer can be improved by creating nano-sized versions of pharmaceutical and natural medicines. Drug delivery has been found to be improved by novel nano-formulations such liposomes, polymeric micelles, dendrimers, quantum dots, nano-suspensions, and gold nanoparticles. Chemotherapeutic chemicals that are delivered more effectively target cancer cells rather than healthy cells, reducing the likelihood of side effects and chemotherapeutic drug resistance. Nanotechnology-based imaging contrast agents that may target particular tumours and hence improve tumour identification have changed cancer diagnostics. Nanotechnology may also be utilised to provide nutraceuticals, such as phytochemicals, which have a variety of benefits, including antioxidant activity, which protects cells from oxidative damage and lowers the risk of cancer. The use of nanotechnology to improve the delivery of pharmaceutical and nutraceutical products in cancer prevention, diagnosis, and therapy has undergone several improvements and implications [3].

The invention of nanotechnology gave rise to countless possibilities in a variety of disciplines. The subject of nano-medicine is the most pertinent to this review. In particular, this technol-

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Corresponding author Boon Mian Teo, Department of Chemistry, Monash University, Clayton, Australia, E-mail: boon_mt@edu.as

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ogy has made it possible to choose among formulations that have advantages that weren't previously accessible in cancer therapy. These advantages include concentrating the medicine in a particular tissue for enhanced exposure to cancer cells, starting the apoptotic process, and targeting tumour cells. The success of these nano-pharmaceuticals has established the validity of this technology and demonstrated its potential in the field of oncology, which has been particularly constrained by numerous barriers, including development costs, regulatory frameworks, the applicability of test protocols, and mechanisms to test for safety and efficacy. Nanotechnology has great promise for the detection, treatment, and maybe even creation of vaccinations of cancer. By focusing on certain cancer biomarkers such exosomes, cancer-associated proteins, circulating tumour DNA, and tumour cells, nanotechnology enables more accurate cancer detection. Although nanotechnology has been thoroughly investigated in experimental settings, clinical data are frequently absent. The use of nanotechnology to improve the sensitivity and specificity of cancer detection is the subject of several current experiments. Ultrasmall silica particles are now being tested in a phase 1 study for human brain tumour imaging.

The first human experiment examining silica NPs in brain tumours is now underway. Future targeted oncological therapeutics might benefit from an understanding of the human silica NP distribution and excretion processes. In order to determine if carbon NPs can improve lymph node yield following surgery, carbon NPs are being explored as lymph node tracers in colorectal tumours. Magnetic resonance using ferumoxytol-iron oxide NPs is being investigated as a potential method to learn more about the progression of malignancies [4].

CONCLUSION

Given the complexity of the components, functions, and actions of therapeutic agents, analytical considerations of nano-pharmaceuticals for cancer therapy are essential to formulation quality control. The presence and concentration of the active principle, the surface qualities, the chemical makeup of the medication, the physical formulation (solid or liquid), and the route of administration are the six factors that determine how nanodrugs work and function. All of these variables are therefore candidates for optimization, which should ultimately provide non-toxic, selective, and effective nano-pharmaceuticals. Another important factor that affects the therapeutic efficacy of nano-pharmaceuticals is their stability. Numerous uses for nano-pharmaceuticals have been discovered in the treatment of cancer, including immunotherapy, gene therapy, site-specific targeting to lessen systemic toxicity, controlled release techniques, and even theragnostic.

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CONFLICT OF INTEREST

There are no conflicts of interest.

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