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REVIEW

A new era of cancer treatment: carbon nanotubes as drug delivery tools

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Abstract: Cancer is a generic term that encompasses a group of diseases characterized by an uncontrolled proliferation of cells. There are over 200 different types of cancer, each of which gains its nomenclature according to the type of tissue the cell originates in. Many patients who succumb to cancer do not die as a result of the primary tumor, but because of the systemic effects of metastases on other regions away from the original site. One of the aims of cancer therapy is to prevent the metastatic process as early as possible. There are currently many therapies in clinical use, and recent advances in biotechnology lend credence to the potential of nanotechnology in the fight against cancer. Nanomaterials such as carbon nanotubes (CNTs), quantum dots, and dendrimers have unique properties that can be exploited for diagnostic purposes, thermal ablation, and drug delivery in cancer. CNTs are tubular materials with nanometer-sized diameters and axial symmetry, giving them unique properties that can be exploited in the diagnosis and treatment of cancer. In addition, CNTs have the potential to deliver drugs directly to targeted cells and tissues. Alongside the rapid advances in the development of nanotechnology-based materials, elucidating the toxicity of nanoparticles is also imperative. Hence, in this review, we seek to explore the biomedical applications of CNTs, with particular emphasis on their use as therapeutic platforms in oncology.

Keywords: carbon nanotubes, cancer, photothermal therapy, drug delivery, cytotoxicity, near infrared

Introduction

In the UK there are more than 293,000 newly diagnosed cases of cancer each year. More than one in three people will develop some form of cancer in their lifetime.[1] The most commonly diagnosed cancers among people in the UK are cancer of the breast and lung and colorectal cancer. Lung and colorectal cancer are the most common causes of death from cancer. The current arsenal against cancer includes surgical resection, chemotherapy, radiotherapy, or a combination of these three modalities.[2] In spite of improvements in the efficiency of treatments over the last few decades, the majority of conventional chemotherapeutic formulations (tablet, capsule, injection) pose multiple problems, such as systemic toxicity and a destructive "bystander" effect to neighboring cells. In addition, there are risks of nephrotoxicity, neurotoxicity, vascular toxicity, infertility, and thromboembolic complications, as well as the more commonly anticipated side effects, such as hair loss, nausea, and myocardial infarction.

Other problems incurred with conventional chemotherapy include the inability of drugs to access tumor sites specifically, and difficulty in clinical administration of drugs.[3] For these reasons, the two main areas that have been addressed by different

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