CHALLENGES AND ADVANCES IN LUNG CANCER TREATMENT

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Lung cancer is among the malignant tumors that are most frequently found.

With a high rate of morbidity and mortality, non-small cell lung cancer (NSCLC) is the most prevalent form of lung cancer. Radiotherapy, chemotherapy, targeted therapy, and surgical resection are all part of the current treatment arsenal. The outlook remains quite poor despite these options, with a dismal 5-year survival rate. Therefore, it is essential to strive for a paradigm shift in therapeutic methodologies. The creation of sophisticated biotechnologies and interdisciplinary integration in recent years have enabled the use of modern lung cancer treatment techniques. The most current developments in immunotherapy, photothermal therapy, molecular targeted therapy, and nanodrug delivery for lung cancer are examined in this article.

Keywords: Lung cancer, nano drug delivery system, molecular targeted,treatment system, photothermal treatment strategy, immunotherapy.

The introduction

Lung cancer is one of the most common diseases in the globe due to its high rate of morbidity and mortality [1]. Based on the histology of the cancer cells, lung cancer is primarily divided into two categories: small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC). NSCLC is the most common subtype of lung cancer, accounting for 85–90% of all forms of the disease. Non-small cell lung cancer (NSCLC) is composed of a number of histological subgroups, including lung adenocarcinoma (LUAD), lung squamous carcinoma, and large-cell lung cancer [2]. Adjuvant therapy is used in addition to surgical tumor removal for stage I or II non-small cell lung cancer. On the other hand, when the disease reaches stage III or IV, radiation treatment or chemotherapy are employed [3], [4].

However, limited absorption, non-specific targeting, and the development of drug resistance are some of the major problems with traditional chemotherapy drugs that limit their effectiveness in treating cancer [5].

The nanodrug delivery system's special properties allow it to encapsulate therapeutic ingredients and prevent their degradation. This reduces non-specific harm to the target tissue and accurately delivers anticancer drugs to tumor locations, increasing anticancer efficacy [6, 7, 8, 9].

Drug distribution by nanocarriers is a ground-breaking method of treating lung cancer because of the following benefits. These include enhanced safety through site-specific anticancer medication delivery, enhanced drug absorption in the body, and the capacity to release medications with controlled release over time during targeted drug administration, all of which enhance the therapeutic effects on the lungs. The delivery system for nanomedicine is a promising treatment approach to research in the field of lung cancer therapy. It provides an alternative to the conventional chemotherapy treatment, which has a number of side effects [10].One important method of treating NSCLC is molecular targeted therapy [1,2].

Numerous receptor tyrosine kinases, such as hepatocyte growth factor receptor (c-Met), epidermal growth factor receptor (EGFR), and anaplastic lymphoma kinase (ALK), are crucial targets for molecular targeted therapy due to their involvement in cell survival and development [4], [5]. Tyrosine kinase inhibitors, like erlotinib and gefitinib, are made to specifically target EGFR mutations, which are the intended therapeutic target. There are also active investigations on inhibitors that target several targets [8].

Despite the availability of several lung cancer treatments, there are still many challenges to be solved. Therefore, new and effective lung cancer treatment approaches need to be developed.

Nanomedicine delivery methods for the treatment of lung cancer.

The structure of nanoparticles has the following advantages: controlled drug release, enhanced anticancer drug stability, and ease of surface modification [1]. Nanoparticles minimize adverse effects and increase therapeutic efficacy by delivering nucleic acids and anti-cancer drugs to tumor tissues via their unique properties (Fig. 1). With a focus on those mediated by various types of nanoparticles, such as liposomes, exosomes, polymer nanoparticles, magnetic nanoparticles, lipid nanoparticles, and polylactic-co-glycolic acid, this section provided a comprehensive analysis of lung cancer treatment employing nano-drug delivery systems.

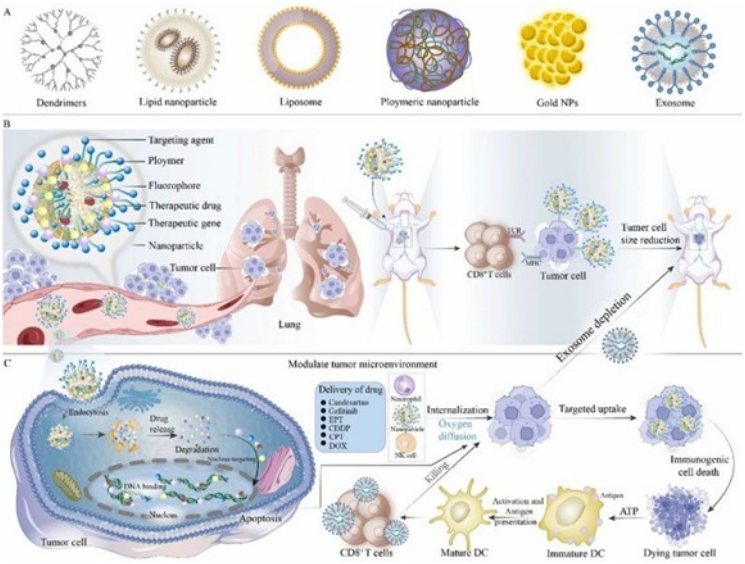

Figure 1: Schematic representation of drugs delivered using nanotechnology for the treatment of lung cancer. It was necessary to modify specific ligands in this process so that NPs could more accurately target and destroy tumor cells. Compared to traditional therapeutic pharmaceuticals, these nanoparticle-based drug delivery systems had the advantage of more effectively and precisely delivering drugs to tumor tissues, which decreased side effects.

Materials and methods Immunization

An innovative method of combating lung cancer was immunotherapy. It included a variety of methods, such as immune checkpoint inhibitors (ICIs), cancer vaccines, and cellular immunotherapies, to develop or enhance effective immune responses against tumors (Fig. 4). In addition to improving patient survival and quality of life, immunotherapy has been shown to have less side effects than chemotherapy [7], [8]. Immunotherapy was a safe and successful treatment option for lung cancer [9], [11].

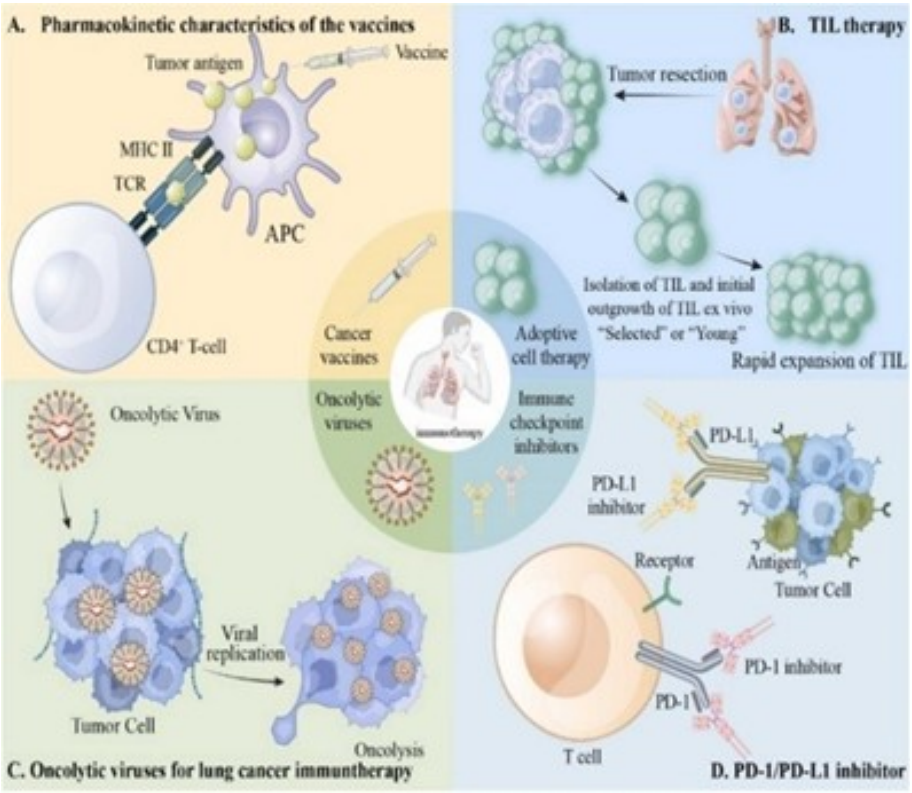

Figure 4. A schematic illustration of the various immunotherapy strategies for lung cancer was displayed. These strategies included: A: Immunotherapy, which prevents lung cancer by using vaccines specific to a given tumor. B: Applying TIL therapy. C: Immunotherapy for lung cancer using oncolytic viruses. D: Immunotherapy for lung cancer with immune checkpoint inhibitors.

Results and discussion

Therapeutic cancer vaccines that target specific immune system stimulation may enhance anti-tumor immune responses [3]. Because of their tumor specificity, mutated neoantigens from cancer cells were excellent targets for T cell-mediated immunity and had a high potential to activate anti-tumor immune responses. In order to develop personalized therapeutic cancer vaccines, these parameters were investigated [3], [4].

In summary

Despite advancements in medicine, lung cancer still has an alarmingly high prevalence and death rate worldwide. It is true that lung cancer mortality can be reduced by early screening and identification. Although our understanding of the molecular biology and clinical features of lung cancer patients has improved over the last few decades, a really effective treatment is yet unreachable. This is due to the fact that standard chemotherapy regimens for lung cancer have a lot of disadvantages, which is a persistent issue for the medical community. Therefore,

more efficient and well-tolerated lung cancer therapy methods are desperately needed.

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