

Lung Cancer Therapies: From Surgery to Immunotherapy

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Introduction

Lung cancer remains one of the leading causes of cancer-related deaths worldwide. Over the years, significant advancements have been made in the field of lung cancer therapies, ranging from traditional surgical approaches to cutting-edge immunotherapy treatments. This article explores the evolution of lung cancer treatments, highlighting the key modalities such as surgery, chemotherapy, radiation therapy, targeted therapy and immunotherapy. By understanding the diverse arsenal of therapies available, patients and healthcare professionals can make informed decisions to combat this complex disease effectively. Lung cancer represents a significant global health burden, with millions of new cases diagnosed each year. Despite improvements in early detection and treatment strategies, it remains one of the most challenging cancers to manage. Surgery has long been a cornerstone in the treatment of lung cancer, especially in early-stage disease. The primary goal of surgical intervention is to remove the tumor and any affected surrounding tissue while preserving maximal lung function. Procedures such as lobectomy, pneumonectomy and wedge resection are commonly performed depending on the extent and location of the tumor. With advancements in surgical techniques, including minimally invasive approaches such as Video-Assisted Thoracoscopic Surgery (VATS) and robotic-assisted surgery, patients now experience reduced postoperative pain, shorter hospital stays and faster recovery times. For patients with advanced or inoperable lung cancer, systemic therapies such as chemotherapy and radiation therapy play a vital role in controlling the disease and alleviating symptoms [1].

Chemotherapy involves the administration of cytotoxic drugs either alone or in combination to target rapidly dividing cancer cells throughout the body. However, advancements in medical science have revolutionized the landscape of lung cancer therapy, offering patients a spectrum of treatment options tailored to their specific needs. From conventional surgical interventions to innovative immunotherapies, the armamentarium against lung cancer continues to expand, offering hope for improved outcomes and enhanced quality of life. Similarly, radiation therapy utilizes high-energy beams to destroy cancer cells or inhibit their growth. These modalities can be used as primary treatments, adjuvant therapies following surgery, or palliative measures to improve quality of life in advanced stages of the disease. In recent years, significant progress has been made in understanding the molecular mechanisms driving lung cancer growth and progression. This has led to the development of targeted therapies that specifically target aberrant signaling pathways implicated in cancer development. These targeted agents, such as epidermal growth factor receptor inhibitors and anaplastic lymphoma kinase inhibitors, offer a more precise and personalized approach to treatment, resulting in improved outcomes and reduced toxicity compared to traditional chemotherapy. However, challenges such as acquired resistance remain a concern, driving ongoing research efforts to overcome treatment limitations [2].

One of the most promising developments in lung cancer therapy is the advent of immunotherapy, which harnesses the body's immune system to

recognize and destroy cancer cells. Immune checkpoint inhibitors, such as programmed cell death protein 1 and programmed death-ligand 1 inhibitors have demonstrated remarkable efficacy in a subset of lung cancer patients, particularly those with advanced or metastatic disease. By unleashing the immune system's ability to mount an anti-tumor response, immunotherapy offers the potential for durable responses and long-term disease control. However, not all patients respond to immunotherapy, highlighting the need for biomarkers and predictive factors to identify suitable candidates. As our understanding of lung cancer biology continues to evolve, combination therapies incorporating multiple modalities are emerging as a promising strategy to improve treatment outcomes. Combinations of chemotherapy, targeted therapy and immunotherapy are being investigated in clinical trials to enhance efficacy and overcome resistance mechanisms. Furthermore, ongoing research efforts are focused on identifying novel therapeutic targets, refining treatment algorithms and developing innovative delivery systems to optimize drug delivery and minimize adverse effects. The future of lung cancer therapy holds great promise, driven by collaborative research efforts and technological innovations aimed at improving patient outcomes and advancing personalized medicine approaches [3].

Description

Despite the remarkable progress made in lung cancer therapy, several challenges remain that warrant attention and innovation. Firstly, while targeted therapies have shown efficacy in specific molecular subtypes of lung cancer, the emergence of acquired resistance poses a significant clinical hurdle. Researchers are actively investigating combination approaches and novel agents to overcome resistance mechanisms and prolong treatment response. Secondly, while immunotherapy has revolutionized the treatment landscape, not all patients derive benefit from these agents. Biomarkers such as PD-L1 expression levels and tumour mutational burden have been identified as potential predictors of response, but their utility remains variable across different patient populations. Further refinement of predictive biomarkers and development of combination immunotherapy strategies hold promise for expanding the reach of immunotherapy to a broader spectrum of patients. Moreover, disparities in access to innovative therapies and clinical trials persist, particularly among underserved populations and those with limited healthcare resources. Efforts to improve equity in healthcare delivery and increase participation in clinical research are essential to ensure that all patients have access to the latest advancements in lung cancer treatment. Looking ahead, the future of lung cancer therapy lies in harnessing the power of precision medicine, molecular profiling and immunomodulation to tailor treatment strategies to the unique characteristics of each patient's disease. Advances in genomic sequencing technologies, liquid biopsies and artificial intelligence are driving personalized approaches to therapy selection, allowing for more accurate prognostication and treatment optimization [4].

Furthermore, the integration of multidisciplinary care models and patient-centred approaches is crucial for optimizing treatment outcomes and improving patient satisfaction and quality of life. Comprehensive supportive care services, including symptom management, psychosocial support and survivorship care, play a vital role in addressing the holistic needs of lung cancer patients throughout their treatment journey. The evolution of lung cancer therapy represents a testament to the collective efforts of researchers, clinicians, patients and advocates in the ongoing fight against this devastating disease. By embracing a multifaceted approach that combines surgical, systemic and immunomodulatory interventions, we can strive towards better outcomes and enhanced quality of life for individuals affected by lung cancer. Through

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continued collaboration, innovation and advocacy, we can pave the way for a future where lung cancer is not only treatable but ultimately preventable, ensuring that every patient receives the best possible care and support [5].

Conclusion

The landscape of lung cancer therapy has undergone significant transformations in recent years, with a growing emphasis on precision medicine and immunotherapy. From traditional surgical interventions to cutting-edge targeted therapies and immunomodulatory agents, patients now have access to a diverse array of treatment options tailored to their individual needs. However, challenges such as treatment resistance and disease recurrence persist, underscoring the need for continued research and innovation in the field. By leveraging a multimodal approach and embracing emerging therapeutic strategies, we can strive towards improving survival rates and enhancing the quality of life for individuals affected by lung cancer. In summary, the evolution of lung cancer therapies reflects a dynamic interplay between scientific advancements, clinical expertise and patient-centered care, paving the way for a brighter future in the fight against this devastating disease.

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Conflict of Interest

There are no conflicts of interest by author.

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