

Lung Cancer: Progress in Personalized Management

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Introduction

This review provides a comprehensive overview of the latest advancements in lung cancer management, highlighting the evolving landscape of diagnostic tools, surgical techniques, and systemic therapies. It covers emerging therapeutic strategies like targeted therapies and immunotherapies, discussing their impact on patient outcomes and future research directions for personalized treatment approaches[1].

This article chronicles the significant progress made in immunotherapy for non-small cell lung cancer (NSCLC) over the past decade. It discusses the mechanisms of action, clinical trial successes, and the expanding role of immune checkpoint inhibitors in various stages of NSCLC, emphasizing their transformative impact on survival rates and treatment paradigms[2].

This review delves into the intricate world of EGFR-mutated non-small cell lung cancer, outlining the current understanding of EGFR as a therapeutic target. It covers the efficacy and limitations of existing tyrosine kinase inhibitors, discusses mechanisms of resistance, and explores emerging strategies and novel compounds aimed at overcoming these challenges for improved patient outcomes[3].

This systematic review critically examines various international guidelines for lung cancer screening, primarily focusing on low-dose computed tomography (LDCT). It highlights the commonalities and differences in recommendations regarding eligibility criteria, screening intervals, and management of detected nodules, providing insights into best practices for implementing effective screening programs[4].

This article reviews the recent advancements in understanding the biology of small cell lung cancer (SCLC) and the emerging therapeutic opportunities. It discusses the molecular heterogeneity of SCLC, the role of immunotherapy in combination with chemotherapy, and other novel agents and strategies that hold promise for improving outcomes in this aggressive malignancy[5].

This guide provides practical insights into the use of liquid biopsy in the clinical management of non-small cell lung cancer (NSCLC). It covers the applications of circulating tumor DNA (ctDNA) for molecular profiling, monitoring treatment response, detecting minimal residual disease, and identifying resistance mechanisms, offering a roadmap for integrating this non-invasive tool into routine practice[6].

This article reviews the groundbreaking role of adjuvant immunotherapy in improving outcomes for patients with early-stage non-small cell lung cancer (NSCLC) following surgical resection. It discusses pivotal clinical trials demonstrating the benefit of immune checkpoint inhibitors in reducing recurrence and extending disease-free survival, marking a paradigm shift in the post-operative management of NSCLC[7].

This overview details the evolution and current state of modern radiotherapy techniques for lung cancer. It covers advanced approaches like stereotactic body radiotherapy (SBRT), proton therapy, and image-guided radiotherapy (IGRT), discussing how these innovations enhance precision, minimize toxicity, and improve local control, while also touching upon future directions in combining radiation with systemic therapies[8].

This review explores the transformative potential of artificial intelligence (AI) across various aspects of lung cancer management. It highlights AI's application in enhancing diagnostic accuracy through image analysis, improving prognostic prediction, and optimizing treatment selection, while also discussing the challenges and ethical considerations involved in integrating AI into clinical practice[9].

This article meticulously examines the complex mechanisms underlying resistance to targeted therapies in non-small cell lung cancer (NSCLC). It delves into both on-target and off-target resistance pathways, including secondary mutations, bypass signaling, and phenotypic changes, and discusses strategies to overcome these challenges through novel drug combinations and sequential therapies to sustain treatment efficacy[10].

Description

Modern lung cancer management is characterized by significant advancements across diagnostic tools, innovative surgical techniques, and a diverse array of systemic therapies. This progression actively shapes an evolving landscape, driving the adoption of more personalized treatment approaches. Here, emerging therapeutic strategies, such as targeted therapies and immunotherapies, are discussed for their profound impact on patient outcomes and their role in directing future research [1]. In parallel, the field of radiotherapy has seen remarkable evolution, with contemporary techniques like Stereotactic Body Radiotherapy (SBRT), proton therapy, and Image-Guided Radiotherapy (IGRT) now commonly employed. These advanced methods are crucial for enhancing precision, minimizing toxicity to surrounding healthy tissues, and improving local tumor control. There is also a strong focus on future directions involving the synergistic combination of radiation with systemic therapies to further elevate treatment efficacy [8].

Immunotherapy has undeniably made significant strides over the past decade, especially in the context of Non-Small Cell Lung Cancer (NSCLC). This progress is extensively chronicled, highlighting the mechanisms of action, numerous clinical trial successes, and the expanding role of immune checkpoint inhibitors across various stages of NSCLC. What this really means is their transformative impact on patient survival rates and the fundamental shifts they've caused in treatment paradigms [2]. Extending this impact, adjuvant immunotherapy has emerged as a groundbreaking strategy, dramatically improving outcomes for pa-

tients with early-stage NSCLC following surgical resection. Pivotal clinical trials have clearly demonstrated the substantial benefit of immune checkpoint inhibitors in not only reducing recurrence but also extending disease-free survival, marking a true paradigm shift in the post-operative management of NSCLC [7].

Understanding the intricate world of EGFR-mutated NSCLC is paramount, as it outlines the current comprehension of EGFR as a key therapeutic target. This involves a thorough examination of the efficacy and limitations of existing tyrosine kinase inhibitors, a discussion of the underlying mechanisms of resistance, and an exploration of emerging strategies and novel compounds specifically designed to overcome these persistent challenges for improved patient outcomes [3]. Furthermore, a meticulous examination of the complex mechanisms contributing to resistance against targeted therapies in NSCLC reveals both on-target and off-target resistance pathways. These include the development of secondary mutations, activation of bypass signaling, and various phenotypic changes, all requiring innovative strategies, such as novel drug combinations and sequential therapies, to sustain treatment efficacy [10]. Simultaneously, recent advancements have brought new insights into the biology of Small Cell Lung Cancer (SCLC) and unveiled promising therapeutic opportunities. This involves critically discussing the molecular heterogeneity inherent in SCLC, the evolving role of immunotherapy when combined with chemotherapy, and other novel agents and strategies that collectively hold significant promise for improving outcomes in this particularly aggressive malignancy [5].

Critically examining various international guidelines for lung cancer screening is essential, with a primary focus on low-dose computed tomography (LDCT). These guidelines highlight commonalities and differences in recommendations regarding eligibility criteria, optimal screening intervals, and the effective management of detected nodules. This provides invaluable insights into best practices for implementing effective screening programs globally [4]. Beyond initial screening, liquid biopsy is proving to be an indispensable tool in the clinical management of NSCLC. This guide offers practical insights into the applications of circulating tumor DNA (ctDNA) for comprehensive molecular profiling, precise monitoring of treatment response, early detection of minimal residual disease, and accurate identification of resistance mechanisms, thereby offering a practical roadmap for integrating this non-invasive tool into routine practice [6].

Finally, the transformative potential of Artificial Intelligence (AI) across various aspects of lung cancer management cannot be overstated. AI's applications are significantly enhancing diagnostic accuracy through sophisticated image analysis, improving prognostic prediction models, and optimizing treatment selection strategies. While these innovations offer immense promise, the integration of AI into clinical practice also necessitates careful consideration of inherent challenges and ethical implications to ensure its responsible and effective deployment [9].

Conclusion

Lung cancer management is rapidly evolving, driven by significant advancements in diagnostic tools, surgical techniques, and systemic therapies, including highly effective targeted therapies and immunotherapies, all contributing to more personalized treatment approaches. Immunotherapy, in particular, has marked a decade of transformative progress in Non-Small Cell Lung Cancer (NSCLC), with immune checkpoint inhibitors dramatically improving survival rates and reshaping treatment paradigms across various disease stages. Research continues to tackle the complexities of EGFR-mutated NSCLC, focusing on overcoming resistance mechanisms to tyrosine kinase inhibitors and developing novel therapeutic compounds for improved patient outcomes. Global efforts are also refining lung cancer screening guidelines, especially for low-dose computed tomography (LDCT), aiming to optimize eligibility criteria, screening intervals, and the management of de-

tected nodules for more effective programs. For aggressive Small Cell Lung Cancer (SCLC), new biological insights are paving the way for promising therapeutic opportunities, including the synergistic use of immunotherapy with chemotherapy and other innovative agents. Liquid biopsy, specifically through the analysis of circulating tumor DNA (ctDNA), is emerging as a practical, non-invasive tool in NSCLC for precise molecular profiling, monitoring treatment response, and detecting minimal residual disease. Adjuvant immunotherapy has revolutionized the post-operative care of early-stage NSCLC, demonstrating remarkable success in reducing recurrence and extending disease-free survival. Modern radiotherapy techniques, such as Stereotactic Body Radiotherapy (SBRT), proton therapy, and Image-Guided Radiotherapy (IGRT), are enhancing treatment precision and local tumor control while minimizing toxicity, with future prospects involving their integration with systemic therapies. Furthermore, Artificial Intelligence (AI) holds immense potential to revolutionize lung cancer management, offering improvements in diagnostic accuracy via image analysis, prognostic prediction, and treatment optimization, though ethical considerations are paramount. Lastly, a crucial area of research involves meticulously dissecting the intricate mechanisms of resistance to targeted therapies in NSCLC, including both on-target and off-target pathways, to inform strategies for novel drug combinations and sequential therapies to sustain treatment efficacy.

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Conflict of Interest

None.

References

1. Hany S. El-Shaar, Ahmed H. Mostafa, Mostafa E. El-Badrawy. "Advances in lung cancer: a review of current management and future directions." *Clin Lung Cancer* 24 (2023):1-13.
2. Solange Peters, Tony Mok, Fabrice Barlesi. "Immunotherapy in non-small cell lung cancer: a decade of progress." *Nat Rev Clin Oncol* 19 (2022):700-717.
3. Giulia Galli, Marcello Di Giacomo, Simona De Carlo. "Targeting EGFR in NSCLC: current knowledge and future perspectives." *Cancers (Basel)* 15 (2023):363.
4. John K. H. Ng, Natalie Z. P. Koh, Yiong-Huak Chan. "Lung Cancer Screening: A Systematic Review of Guidelines." *J Thorac Oncol* 16 (2021):1076-1085.
5. Roman K. Thomas, Charles M. Rudin, Luis Paz-Ares. "Small cell lung cancer: New insights and therapeutic opportunities." *Nat Rev Clin Oncol* 17 (2020):519-531.
6. Adrian Gabriel S. de la Fuente, Jennifer L. Rotow, Clarissa S. Cho. "Liquid Biopsy for Non-Small Cell Lung Cancer: A Guide for Clinical Practice." *J Thorac Oncol* 16 (2021):1789-1805.
7. Heather A. Wakelee, Enriqueta Felip, Rafael Rosell. "Adjuvant Immunotherapy in Early-Stage Non-Small Cell Lung Cancer." *J Clin Oncol* 40 (2022):515-524.
8. Corinne Faivre-Finn, Frank J. Lagerwaard, Benjamin T. G. Jones. "Modern radiotherapy for lung cancer: an overview of current approaches and future perspectives." *Lancet Respir Med* 9 (2021):1435-1447.
9. Yuanshu Zhang, Min Tao, Zhengyu Peng. "Artificial Intelligence in Lung Cancer Diagnostics and Prognosis: A Review." *Cancers (Basel)* 15 (2023):2760.

10. Enriqueta Felip, Julien Mazieres, Tony Mok. "Mechanisms of Resistance to Targeted Therapies in Non-Small Cell Lung Cancer." *Clin Cancer Res* 29 (2023):2145-2158.

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