Lung cancer breakthroughs: Ai, biomarkers, targeted therapies.

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Introduction

This systematic review explores the application of deep learning algorithms in the detection and classification of lung cancer from CT scans. It synthesizes current research, highlighting the effectiveness of various deep learning models in improving diagnostic accuracy and discusses the challenges and future directions for integrating these technologies into clinical practice. The review emphasizes the potential for AI to enhance early detection and streamline the diagnostic process, ultimately improving patient outcomes.[1].

This article discusses the advancements in inhalable nanoparticle-mediated drug delivery systems for lung cancer therapy. It covers various types of nanoparticles, their advantages in targeted delivery, enhanced bioavailability, and reduced systemic toxicity, and challenges associated with their clinical translation. The review highlights how these innovative systems offer a promising strategy to improve therapeutic efficacy by directly delivering drugs to lung tumor sites, bypassing traditional intravenous routes.[2].

This study investigates the respiratory mechanics in lung cancer patients requiring mechanical ventilation, a critical aspect often overlooked in clinical management. It analyzes factors influencing lung compliance and resistance, offering insights into optimal ventilation strategies to minimize ventilator-induced lung injury and improve outcomes in this vulnerable patient population. Understanding these mechanics is crucial for personalized respiratory support.[3].

This review article provides a comprehensive overview of liquid biopsy applications in lung cancer, spanning from early diagnosis and staging to monitoring treatment response and detecting minimal residual disease. It details various circulating biomarkers, such as circulating tumor DNA, circulating tumor cells, and exosomes, emphasizing their non-invasive nature and potential to revolutionize personalized medicine for lung cancer patients.[4].

This review examines current strategies and emerging technologies for the early detection and screening of lung cancer. It discusses the efficacy of low-dose computed tomography (LDCT) screening programs, as well as novel biomarker-based approaches that aim to identify high-risk individuals and pre-cancerous lesions more accurately. The article underscores the importance of early diagnosis in improving survival rates and reducing mortality associated with lung cancer.[5].

This article highlights innovative advancements in inhalation drug delivery systems for lung cancer therapy. It covers novel formulation strategies, such as microparticles and nanoparticles, and advanced device technologies designed to optimize drug deposition and retention in the lungs. The review underscores the benefits of targeted pulmonary delivery in maximizing therapeutic efficacy while minimizing systemic side effects for lung cancer treatment.[6].

This narrative review explores the increasing role of artificial intelligence (AI) in mechanical ventilation, discussing how AI algorithms can personalize ventilation settings, predict patient responses, and optimize respiratory support. While not exclusively focused on lung cancer, the principles apply to managing critically ill patients, including those with respiratory complications from lung cancer or its treatment, aiming to improve patient safety and outcomes in intensive care.[7].

This review highlights recent advancements in non-invasive diagnostic biomarkers for lung cancer, focusing on their potential for early detection and personalized management. It delves into the utility of various circulating markers, including proteins, nucleic acids, and metabolites, in bodily fluids. The article underscores how these biomarkers can contribute to a more accurate and less invasive diagnostic pathway, complementing traditional imaging techniques and improving patient stratification.[8].

This review focuses on the innovative application of nanotechnology-based systems for inhalation therapy in lung cancer. It explores how nanoparticles can precisely deliver therapeutic agents to cancerous cells in the lungs, enhancing drug efficacy while minimizing systemic toxicity. The article discusses various nanocarrier designs and their mechanisms of action, highlighting their potential to overcome challenges associated with conventional lung cancer treatments and revolutionize targeted drug delivery.[9].

This article provides an update on the current status and future perspectives of low-dose CT (LDCT) lung cancer screening. It dis-

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Received: 01-Jul-2025, Manuscript No. AAJPCR-25-211; **Editor assigned:** 03-Jul-2025, Pre QC No. AAJPCR-25-211 *(PQ)*; **Reviewed:** 23-Jul-2025, QC No. AAJPCR-25-211; **Revised:** 01-Aug-2025, Manuscript No. AAJPCR-25-211 *(R)*; **Published:** 12-Aug-2025, DOI: 10.35841/aajpcr-8.4.211

Citation: Santos G. Lung cancer breakthroughs: Ai, biomarkers, targeted therapies. J Pulmonol Clin Res. 2025;08(04):211.

cusses recent clinical trial findings, advancements in screening protocols, and the integration of artificial intelligence to improve nodule detection and characterization. The review emphasizes the benefits of LDCT in reducing lung cancer mortality among high-risk populations, while also addressing challenges like overdiagnosis and patient compliance.[10].

Conclusion

Recent advances in lung cancer research highlight a multifaceted approach to improving patient outcomes. Deep learning and Artificial Intelligence (AI) are revolutionizing detection and classification from CT scans, enhancing diagnostic accuracy, and streamlining processes for early identification [1, 10]. Alongside imaging, liquid biopsy and non-invasive biomarkers are emerging as crucial tools for early diagnosis, staging, treatment monitoring, and personalized medicine, leveraging circulating tumor DNA, cells, and exosomes [4, 5, 8]. Low-Dose CT (LDCT) screening remains vital for high-risk populations, with AI integration further refining nodule detection [5, 10]. Therapeutically, innovative inhalation drug delivery systems, particularly those utilizing nanoparticles, offer promising strategies for targeted drug delivery, enhanced bioavailability, and reduced systemic toxicity by directly treating lung tumor sites [2, 6, 9]. Patient management also sees progress, with studies focusing on respiratory mechanics in mechanically ventilated lung cancer patients to optimize care and minimize injury, complemented by AI applications in mechanical ventilation for personalized support [3, 7]. Together, these advancements represent a significant leap towards more effective diagnosis, treatment, and critical care for lung cancer.

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Citation: *Santos G. Lung cancer breakthroughs: Ai, biomarkers, targeted therapies. J Pulmonol Clin Res. 2025;08(04):211.*