Lung cancer screening: Evolution, diagnosis, challenges.

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Introduction

Modern oncology places significant emphasis on early detection strategies, particularly for aggressive diseases like lung cancer. Low-dose computed tomography (LDCT) screening has emerged as a cornerstone in reducing lung cancer mortality. A comprehensive update on lung cancer screening recommendations using LDCT highlights critical eligibility criteria, appropriate screening intervals, and the precise management protocols for detected nodules [1].

These guidelines underscore the importance of shared decision-making, where an individual's unique risk factors, comorbidities, and overall health status—including pulmonary function—are key considerations [1]. The utility of Pulmonary Function Tests (PFTs) extends further, helping to identify individuals at a higher risk for lung cancer or poor surgical outcomes [2]. PFTs are also instrumental in guiding shared decision-making for screening eligibility, especially for patients presenting with significant airflow obstruction [2]. Moreover, updated guidelines detail the crucial role of PFTs for preoperative risk stratification in patients slated for lung resection due to suspected or confirmed lung cancer, aiding in determining surgical candidacy and predicting postoperative lung function [8].

The efficacy of lung cancer screening has been rigorously validated through large-scale clinical trials. The pivotal NELSON trial, for instance, confirmed that screening with volume Computed Tomography (CT) substantially reduces lung cancer mortality in both men and women [4]. This study provides strong evidence advocating for the implementation and expansion of organized lung cancer screening initiatives, reinforcing the favorable benefit-to-harm ratio associated with LDCT for early detection [4]. Complementing this, research from the National Lung Screening Trial (NLST) data has led to the development and validation of updated risk calculators for lung cancer mortality [5]. These sophisticated tools are essential for refining screening eligibility, moving beyond basic age and smoking pack-year criteria to incorporate additional risk factors, thereby optimizing patient selection and efficient resource allocation [5].

When a lung nodule is detected through screening, the subsequent diagnostic pathway is critical. Endobronchial Ultrasound-Guided Transbronchial Needle Aspiration (EBUS-TBNA) plays an essential role in the diagnosis and staging of lung cancer, particularly for mediastinal and hilar lymph nodes [3]. This minimally invasive procedure has seen advancements and its applications continue to evolve [3]. An optimal diagnostic approach for lung cancer, from initial nodule detection to definitive diagnosis and staging, emphasizes a multidisciplinary framework [6]. This integrated strategy includes advanced imaging, bronchoscopy—with EBUS being vital for nodal staging—and surgical biopsy, ensuring accurate and efficient patient management within the screening paradigm [6]. Beyond its primary use in nodal staging, convex probe EBUS-guided transbronchial needle aspiration (CP-EBUS-TBNA) has shown diagnostic yield and safety for evaluating carefully selected peripheral lung lesions [9]. This extended application can potentially reduce the need for more invasive procedures following the initial detection of a nodule during screening [9].

Despite the evident advantages of lung cancer screening programs, there are inherent challenges to address. One significant concern is the extent of overdiagnosis, where a proportion of detected cancers might not have progressed to cause harm during a patient's lifetime [7]. A systematic review and meta-analysis on this topic underscore the ongoing challenge of balancing the life-saving benefits of screening with potential harms like overdiagnosis [7]. Furthermore, the practical implementation of lung cancer screening programs faces various hurdles [10]. These include effective patient recruitment, ensuring consistent adherence to screening protocols, adeptly managing incidental findings, and establishing robust infrastructure alongside multidisciplinary coordination to fully realize the benefits identified in clinical trials [10]. Effectively navigating these complexities is paramount for successful widespread adoption and sustained impact of lung cancer screening initiatives.

Conclusion

Lung cancer screening using low-dose computed tomography (LDCT) has significantly evolved, with guidelines emphasizing eligibility criteria, screening intervals, and effective management of detected nodules. Shared decision-making, integrating individual risk factors and comorbidities like pulmonary function, is crucial for comprehensive patient assessment. Pivotal studies, such as the

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Received: 01-Aug-2024, Manuscript No. AAJPCR-24-179; **Editor assigned:** 05-Aug-2024, Pre QC No. AAJPCR-24-179 *(PQ)*; **Reviewed:** 23-Aug-2024, QC No. AAJPCR-24-179; **Revised:** 03-Sep-2024, Manuscript No. AAJPCR-24-179 *(R)*; **Published:** 12-Sep-2024, DOI: 10.35841/aajpcr-7.2.179

Citation: Orlov V. Lung cancer screening: Evolution, diagnosis, challenges. J Pulmonol Clin Res. 2024;07(02):179.

NELSON trial, have demonstrated a substantial reduction in lung cancer mortality with volume CT screening, providing robust evidence for widespread program implementation. The National Lung Screening Trial (NLST) data further supports the development of advanced risk calculators, moving beyond basic age and smoking history to optimize patient selection and resource allocation.

Pulmonary Function Tests (PFTs) play a multifaceted role, aiding in identifying high-risk individuals, guiding screening eligibility, and crucial for preoperative risk stratification in patients undergoing lung resection. For diagnosis, endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) is essential for staging, particularly for mediastinal and hilar lymph nodes, and its application extends to carefully selected peripheral lung lesions. The diagnostic journey, from initial nodule detection to definitive diagnosis and staging, necessitates a multidisciplinary approach, integrating imaging, bronchoscopy, and surgical biopsy for accurate patient management.

Despite the clear benefits, challenges persist. Overdiagnosis in screening programs is a concern, highlighting the delicate balance between saving lives and potential harms. Effective implementation of screening programs faces practical hurdles, including patient recruitment, ensuring adherence to protocols, managing incidental findings, and establishing adequate infrastructure and multidisciplinary coordination. Addressing these aspects is vital to maximize the societal benefits of early detection and improved outcomes.

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Citation: *Orlov V. Lung cancer screening: Evolution, diagnosis, challenges. J Pulmonol Clin Res. 2024;07(02):179.*