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# Early detection of lung cancer: Screening tools and emerging biomarkers.

**Kenji Mansoori***

Department of Pulmonology, Tokyo Medical University, Japan

***Correspondence to:** Kenji Mansoori, Department of Pulmonology, Tokyo Medical University, Japan. E-mail: k.mansoori@tokyo-med.ac.jp

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## Introduction

Lung cancer remains one of the leading causes of cancer-related deaths worldwide, largely due to its late diagnosis and aggressive nature. By the time symptoms appear, the disease is often in advanced stages, limiting treatment options and survival rates. However, early detection significantly improves prognosis, and advances in screening tools and the identification of novel biomarkers are transforming how lung cancer is diagnosed and managed [1].

The cornerstone of early lung cancer detection has been the use of low-dose computed tomography (LDCT). This imaging technique has demonstrated its effectiveness in reducing lung cancer mortality, particularly among high-risk individuals, such as long-term smokers aged 50 and above. LDCT is capable of detecting small nodules that may not be visible on standard chest X-rays, allowing for intervention at a stage when the cancer is more likely to be curable [2].

The National Lung Screening Trial (NLST) in the United States was pivotal in establishing the utility of LDCT. It showed a 20% reduction in lung cancer mortality among high-risk populations screened with LDCT compared to those screened with chest X-rays. As a result, LDCT screening has been adopted in several countries as part of national cancer screening programs [3].

Despite its benefits, LDCT is not without limitations. False positives are common, leading to unnecessary invasive procedures and patient anxiety. Additionally, LDCT has limited sensitivity in detecting certain types of lung cancer, such as small-cell lung carcinoma or lesions located near the hilum. This has prompted researchers to explore additional tools that can complement imaging and improve diagnostic accuracy [4].

One promising area of development is the use of biomarkers—biological molecules found in blood, tissue, or other body fluids—that can indicate the presence of cancer. Biomarkers offer the potential for non-invasive, cost-effective screening methods that can be used alone or alongside imaging to refine diagnosis and guide treatment decisions [5].

## Conclusion

In conclusion, early detection remains the most effective strategy for reducing lung cancer mortality. While LDCT is currently the gold standard, its limitations have fueled the search for complementary and more precise screening methods. Emerging biomarkers offer exciting possibilities for non-invasive, accurate, and early identification of lung cancer. Continued research and validation of these tools are crucial for translating scientific advances into clinical practice, ultimately improving survival and quality of life for patients worldwide.

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