Lung Cancer Screening and Its Impact on Surgical Volume

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KEYWORDS

• Lung cancer • Lung cancer screening • Thoracic surgery

KEY POINTS

- Screening for lung cancer in high-risk individuals with annual low-dose computed tomography examinations has been shown to reduce lung cancer mortality by 20%.
- Screening for lung cancer by chest radiography or in low-risk individuals is not recommended.
- Lung cancer screening is recommended by multiple health care organizations and is covered by Medicare and Medicaid.
- Lung cancer screening is projected to increase the case volume for the thoracic surgery workforce.

INTRODUCTION

Lung cancer is the leading cause of cancer-related death in the United States, with 1 out of 4 cancer deaths owing to lung cancer.[1] Each year, more people die of lung cancer than of colon, breast, and prostate cancers combined. For 2016, the American Cancer Society estimates about 224,390 new cases of lung cancer leading to about 158,080 deaths. Lung cancer mainly occurs in older people. Approximately 2 out of 3 people diagnosed with lung cancer are 65 years of age or older, and fewer than 2% are younger than 45 years. The average age at the time of diagnosis is about 70 years.

Cigarette smoking is the leading risk factor for developing lung cancer. Although reduced rates of cigarette smoking in the United States have resulted in a reduced incidence of lung cancer, the substantial burden of lung cancer will continue for many years. Smoking cessation has been the most important public health intervention that has reduced this burden. However, owing to its long preclinical phase and

Disclosures: None.

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Surg Clin N Am 97 (2017) 751–762

http://dx.doi.org/10.1016/j.suc.2017.03.006

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markedly improved outcomes for patients treated at an earlier stage, there is substantial rationale for screening asymptomatic, high-risk individuals to improve the morbidity and mortality from this disease.[2]

Lung cancer screening has been implemented since the early 1960s. Numerous large-scale clinical trials have evaluated the use of chest radiographs, sputum analyses, computed tomography (CT), and most recently low-dose CT (LDCT) scans as screening tools. Coincident with the improvements in imaging technology, there also have been the refinements in surgical techniques for lung resections. With the establishment of lung cancer screening guidelines, the impact on the workforce needed to implement these guidelines are beginning to be studied. This article reviews the lung cancer screening data and its impact on the thoracic surgical workforce.

LUNG CANCER SCREENING TRIALS

Early, large-scale, clinical trials published in the 1980s and 1990s used chest radiographs for lung cancer screening and were disappointing.[3–6] None of the 6 randomized, controlled trials demonstrated any mortality benefit.[3–8] In the PLCO Screening trial (Prostate, Lung, Colorectal, and Ovarian Cancer), 154,942 smokers and nonsmokers from the general population were randomized to the intervention arm with an annual chest radiographs versus the control arm with "usual care," which was standard care as determined by their general health care practitioners.[7] After 13 years of follow-up, only 20% of lung cancers in the screening group were detected by screening, and no mortality benefit was seen in either the general population or the subset determined to be at higher risk of lung cancer based on smoking history and age. The Mayo Clinic conducted a randomized trial of chest radiographs and sputum analysis versus usual care. In a 20-year follow-up of this Mayo Lung Project, significantly more cancers were detected in the screening group; however, there was a higher overall lung cancer death rate, attributed to biased documentation of lung cancer as a cause of death.[8] These studies, along with others, resulted in a recommendation by the US Preventive Services Task Force in 2004 against using chest radiographs for lung cancer screening.[9] With the failure of chest radiography-based screening, centers began evaluating CT-based screening for lung cancer.

Initial studies of LDCT screening were observational, including the ELCAP (Early Lung Cancer Action Project), International ELCAP, the Mayo Clinic CT study, and the COSMOS study (Continuous Observation of Smoking study).[10–13] Owing to the lack of randomization, the studies were subject to lead-time bias and overdiagnosis bias. However, they did demonstrate for the first time the ability of CT to detect lung cancer at an early stage.

The most important randomized, controlled trial to date is the National Lung Screening Trial (NLST) conducted by the National Cancer Institute of LDCT for lung cancer screening.[14,15] To date, it is the only large-scale, randomized trial of LDCT lung cancer screening. Other ongoing randomized trials exist, but may not be adequately powered to detect a mortality benefit. A total of 53,454 high-risk persons at 33 medical centers across the United States were enrolled. Determinants of high risk included age and smoking history: between 55 and 74 years of age with at least 30 pack-years of smoking, and subjects could not have quit smoking more than 15 years before enrollment. Excluded were subjects who had any prior history of lung cancer, unexplained weight loss or symptoms suggestive of lung cancer, other cancers within the past 5 years (other than a nonmelanoma skin cancer), a chest CT scan in the past 18 months, or a medical condition that posed a significant risk of mortality during the trial period.