Development of The American Association for Thoracic Surgery guidelines for low-dose computed tomography scans to screen for lung cancer in North America: Recommendations of The American Association for Thoracic Surgery Task Force for Lung Cancer Screening and Surveillance

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Objective: The study objective was to establish The American Association for Thoracic Surgery (AATS) lung cancer screening guidelines for clinical practice.

Methods: The AATS established the Lung Cancer Screening and Surveillance Task Force with multidisciplinary representation including 4 thoracic surgeons, 4 thoracic radiologists, 4 medical oncologists, 1 pulmonologist, 1 pathologist, and 1 epidemiologist. Members have engaged in interdisciplinary collaborations regarding lung cancer screening and clinical care of patients with, and at risk for, lung cancer. The task force reviewed the literature, including screening trials in the United States and Europe, and discussed local best clinical practices in the United States and Canada on 4 conference calls. A reference library supported the discussions and increased individual study across disciplines. The task force met to review the literature, state of clinical practice, and recommend consensus-based guidelines.

Results: Nine of 14 task force members were present at the meeting, and 3 participated by telephone. Two absent task force members were polled afterward. Six unanimous recommendations and supporting work-up algorithms were presented to the Council of the AATS at the 2012 annual meeting in San Francisco, California.

Conclusions: Annual lung cancer screening and surveillance with low-dose computed tomography is recommended for smokers and former smokers with a 30 pack-year history of smoking and long-term lung cancer survivors aged 55 to 79 years. Screening may begin at age 50 years with a 20 pack-year history of smoking and additional comorbidity that produces a cumulative risk of developing lung cancer of 5% or greater over the following 5 years. Screening should be undertaken with a subspecialty qualified interdisciplinary team. Patient risk calculator application and intersociety engagement will provide data needed to refine future lung cancer screening guidelines. (J Thorac Cardiovasc Surg 2012;144:25-32)

Lung cancer is the leading cause of cancer deaths in the United States and Canada. In 2012, the National Cancer Institute estimates that there will be 226,160 new cases diagnosed and 160,340 deaths in the United States.[1] Ninety-four million current and former smokers in the United States remain at elevated risk for lung cancer, the leading cause of cancer death in the United States and Canada. In Canada, it is estimated that 25,600 new cases will be diagnosed and that 20,200 will die of the disease.[2] The incidence of lung cancer increases with age, and consequently more than half of Americans and Canadians who are diagnosed with lung cancer are aged 70 years or more. Of note,

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Disclosures: John H. M. Austin, Reginald F. Munden, Gary M. Strauss, David J. Sugarbaker, William D. Travis, and Michael T. Jaklitsch have no commercial interests to disclose. Francine L. Jacobson reports grant funding from Toshiba. John K. Field reports advisory board member work for Epigenomics and Roche Diagnostics. James R. Jett reports grant research support from Oncimmune and Metabolomx. Shaf Keshavjee reports grant research support from Astellas Canada and Axela/Exceed, clinical trial support from Vitrolife, and being awarded a Wyeth Pharmaceuticals/CIHR Rx&D Clinical Research Chair in Transplantation. Heber MacMahon reports advisory board member and consultant work for Riverain Medical, consultant work for Biomet, and royalties from UC Tech (University of Chicago). James L. Mulshine reports a family member who is an employee of Accretive Health. Ravi Salgia reports advisory board member work for Cephalon and Methylgene, and research funding from Eli Lilly. Scott J. Swanson reports consulting fees for Ethicon and Covidien.

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0022-5223/$36.00

doi:10.1016/j.jtcvs.2012.05.059

Abbreviations and Acronyms

AATS = American Association for Thoracic Surgery
CT = computed tomography
CXR = chest x-ray
GGN = ground-glass nodule
LDCT = low-dose computed tomography
MDT = multidisciplinary team
NCCN = National Comprehensive Cancer Network
NLST = National Lung Screening Trial
PET = positron emission tomography

between 1996 and 2006, the incidence rates for those aged 75 years or more increased, whereas the overall incidence rates declined.[3] Only 15.9% of those diagnosed with lung cancer survive 5 years, in part because of the association of advanced disease stage with initial symptoms of the disease. This is a lower survival than for cancers with current screening programs (breast, colon, and prostate).

An effective screening program that identifies early-stage disease before symptoms would have a powerful public health impact. Randomized trials for chest x-ray (CXR) and sputum cytology failed to establish a role for screening to detect early-stage lung cancer. The advent of single breath-hold volumetric computed tomography (CT) scanning of the chest at an acceptable level of radiation led to low-dose CT (LDCT) screening trials. The increased incidence of lung cancer coupled with increased therapeutic options and decreased rates of infectious diseases, such as tuberculosis, in the United States and Canada, also helped to increase the potential ability for screening to decrease lung cancer morbidity and mortality. The number of cases of lung cancer in the United States has nearly doubled since 1980, when there were only 117,000 new cases.[4] Tuberculosis peaked in 1993 with more than 26,000 reported cases in the United States, compared with 11,545 cases in 2009.[5] Minimally invasive thoracic surgery techniques pioneered in the 1990s now produce the remarkably low mortality rate found in prospective trials that involve lung cancer resection by lobectomy.[6]

Although demographics and technology have changed, popular opinions also have changed. The realization that tobacco companies deliberately added ingredients to cigarettes that may have increased their addictive potential,[7] and the growing population of ''never smokers'' with lung cancer, especially among women, have changed the perception of lung cancer as a self-inflicted disease.[8]

DEVELOPMENT AND SUCCESS OF LOW-DOSE COMPUTED TOMOGRAPHY

These changes in our modern society led many researchers to believe that the time had come to reexamine methods to screen for early-stage lung cancer. CT scanning with the newer volumetric technology allowed radiologists to identify small nodules and parenchymal features and to study the outcome of patients with these findings in the course of nonrandomized studies in Japan and other countries. The Early Lung Cancer Action Project undertaken by Henschke and colleagues[9] at the Weill-Cornell Medical Center studied this technology in 1000 patients who received both LDCT and CXR in a case-controlled study design. They consolidated the emerging knowledge about the imaging of early lung cancer findings that revolutionized the ability to detect disease before the onset of symptoms. The International Early Lung Cancer Action Program was started in 1993 and screened patients aged 60 years or more with a 10 pack-year smoking history.[10] This single-arm study identified 484 lung cancers in 31,567 subjects. Eighty-five percent of the cancers were stage I, and the 10-year survival of these patients was 88%. In contrast, 8 patients with stage I lung cancer who refused surgery had all died of disease within 5 years. Surgical mortality in this study was 0.05% when board-certified thoracic surgeons in cancer centers provided the surgical care. The International Early Lung Cancer Action Program developed a robust care model; however, improved survival could not be used as a surrogate for decreased mortality.

The National Cancer Institute sponsored a randomized phase III National Lung Screening Trial (NLST) that, for the first time, provided level I evidence that LDCT screening can reduce lung cancer–specific mortality. Between August 2002 and April 2004, 53,454 individuals at high risk for lung cancer enrolled for 3 annual screens, with half receiving LDCT and half receiving CXR; all individuals then received follow-up through 2009 before early termination of the trial, when a 21% reduction in lung cancer–specific mortality was reached in the LDCT arm.[11] This was achieved by a trial designed to have 90% power to detect this level of difference in the most cost-effective manner possible, using only 3 screens of a very high-risk population during the years leading up to the peak age range for lung cancer. The NLST enrolled smokers and former smokers, who quit smoking less than 15 years earlier, between 55 and 74 years of age with at least a 30 pack-year history of cigarette smoking. Subjects were excluded if they had a history of lung cancer, a CT scan of the chest within 18 months of enrollment, hemoptysis, or an unexplained weight loss more than 6.8 kg (15 lbs).[12]

Three consecutive annual screens provided a prevalence screen and 2 annual screens. Longer duration of screening was not economically viable where each annual round of screen generated 26,723 LDCT scans and an equal number of CXR examinations. Positive screens were obtained in 24.2% of the LDCT arm and 6.9% of the CXR arm. Adverse events, including those from needle biopsy and