Screening for Lung Cancer with Low-Dose Helical Computed Tomography: Are We Getting Closer?

Sobue T, Moriyama N, Kaneko M, et al. Screening for lung cancer with low-dose helical computed tomography: anti-lung cancer association project. J Clin Oncol 2002;20:911–20.

Study Overview

Objective. To provide data on lung cancer screening with low-dose helical computed tomography (CT) scanning and its efficacy in terms of survival.

Design. Single-arm prospective screening project.

Setting and participants. This study updates the ongoing Anti-Lung Cancer Association project (ALCA) in Tokyo. The ALCA is a for-profit organization that recruits asymptomatic participants from the general population who smoke or have a history of smoking and are 40 years or older. From 1975 to 1993, the ALCA project screened participants twice annually with chest radiograph and sputum cytology. In 1993, low-dose helical chest CT scanning (10-mm collimation) was incorporated into screening.

Methods. 1611 participants aged 40 to 79 years (86% with a history of smoking) were screened by low-dose helical CT scan, posterior-anterior chest radiograph, and 3-day pooled sputum cytology at 6-month intervals from 1993 to 1998. After initial screening, participants were invited by mail to complete the same screening procedures twice a year. All CT images and chest radiographs were classified according to the following schema (later authorized by the Japan Lung Cancer Society): (A) inadequate imaging; (B) normal; (C) scar lesion; (D) benign tumor or inflammatory disease; and (E) suspected lung cancer. Positive helical CT scans and chest radiographs were defined as those classified as benign tumor or inflammatory disease or suspected lung cancer. These participants were asked to undergo additional diagnostic evaluation involving thin-section CT (2-mm collimation). Participants with suspected lung cancer were referred for CT-guided transbronchial or percutaneous biopsy or video-assisted thoracoscopic surgery. Sputum specimens were classified as follows: (A) inadequate; (B) normal or squamous metaplasia with mild atypia; (C) squamous metaplasia with moderate atypia; (D) squamous metaplasia with severe atypia; or (E) lung cancer. Participants with positive sputum samples (squamous metaplasia with severe atypia or lung cancer) were referred for bronchoscopy.

Main outcome measures. The absolute number and proportion of positive CT scans, chest radiographs, and sputum samples that subsequently identified lung cancer were measured. Differences in proportions and means were evaluated with χ^2 and *t* tests, respectively. The cumulative survival rate for lung cancer cases was calculated using the Kaplan-Meier method.

Main results. 9502 screening examinations were included in the analysis. At initial screening, the proportions of positive tests were 11.5%, 3.4%, and 0.8% using low-dose helical CT scan, chest radiograph, and sputum cytology, respectively. 14 (0.87%) cases of lung cancer were detected; 71% were stage IA with a mean tumor diameter of 19.8 mm. 8 (57%) of these cases were detected by CT scan alone. The positive predictive values for initial CT, radiograph, and sputum were 7%, 9.1%, and 30.8%, respectively. At repeat screening, the respective proportions of positive tests were 9.1% for CT, 2.6% for chest radiograph, and 0.7% for sputum. 16 (73%) of these cases were detected by CT scan alone. The positive predictive values for repeat screening CT, radiograph, and sputum were 2.6%, 1.5%, and 7.7%, respectively. In 7891 re-screening examinations, 22 (0.28%) cases of lung cancer were detected; 82% were stage IA with a mean tumor diameter of 14.6 mm. Tumors detected by CT scan were predominantly peripheral adenocarcinomas under 2 cm, while those detected by sputum were more often central and squamous. The 5-year survival rate for screen-detected lung cancer was 76.2% and 64.9% for initial and repeated screening, respectively.

Conclusion. Screening with low-dose helical CT has the potential to improve screening efficacy in terms of reducing lung cancer mortality.

Commentary

Lung cancer accounts for more cancer deaths each year than colon, breast, and prostate cancers combined [1]. Screening has not been proven to reduce mortality and is not recommended currently. 2 large randomized trials (the Mayo Lung Project and a Czechoslovakian study) comparing screened and unscreened groups using chest radiograph and sputum cytology failed to show reductions in mortality. Noted improvements in stage distribution, resectability, and 5-year survival may have reflected lead-time bias and length-bias

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