

Incidental Anterior Mediastinal Nodular Lesions on Chest CT in Asymptomatic Subjects

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ABSTRACT

Objective: The aim of this study was to investigate the prevalence and characteristics of nodular lesions in the anterior mediastinum that had been found incidentally on screening chest computed tomography (CT) in asymptomatic subjects.

Methods: We included 56,358 consecutive participants (mean age 52.4 ± 10.5 years; male-female ratio 35,306:21,052) who underwent a baseline low-dose chest CT scan as part of a health checkup from 2006 through 2013. After the presence of anterior mediastinal nodular lesion had been confirmed, their CT findings, confirmatory diagnosis, and interval CT scan were reviewed. The standardized prevalence ratio for thymic epithelial tumor was calculated on the basis of the Republic of Korea cancer statistics for 2014.

Results: Of the 56,358 participants, 413 (0.73%) had lesions (95% confidence interval: 0.66–0.80%); the prevalence increased with age ($p < 0.001$) and a history of malignancy ($p = 0.005$). Of the lesions, 85.2% were smaller than 2 cm, 61.3% were round, and 80.2% had CT attenuation higher than 20 Hounsfield units. Among 51 proven cases, 39 lesions (76.9%) were benign and 12 (23.1%) were malignant. The standardized prevalence ratio for thymic epithelial tumor was 2.04 (95% confidence interval: 1.01–3.42). Of 11 resected thymic epithelial tumors, five were carcinomas, 10 were stage I or II, and all were completely resected without recurrence. Of the 237 unconfirmed cases with a follow-up CT scan, 82.2% were stable, 8.9% had increased, and the other 8.9% had decreased.

Conclusions: The prevalence of incidental nodular lesion was 0.73%. Most lesions had CT features that were indistinguishable from thymic epithelial tumors, but a considerable portion of the lesions were suspected to be

benign. Incidental thymic epithelial tumors were more prevalent than clinically detected tumors, were early-stage cancer, and showed favorable outcomes.

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Keywords: anterior mediastinum; incidental lesion; computed tomography; thymus; cancer screening

Introduction

Mediastinal lesions include a variety of benign and malignant diseases, and half of them are located in the anterior mediastinum.¹ With the increasing use of chest computed tomography (CT) imaging in clinical practice² and lung cancer screening,³ asymptomatic anterior mediastinal lesions are being detected more frequently.^{4,5} Thymic lesions are largely responsible for anterior mediastinal lesions, and malignancies such as thymic epithelial tumors are a main concern for asymptomatic incidental anterior mediastinal lesions.⁴

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Two studies so far have evaluated incidental anterior mediastinal lesions on chest CT scan.^{4,5} The Early Lung Cancer Action Program (ELCAP) study reported a prevalence of 0.45% (41 of 9263 participants) (95% confidence interval [CI]: 0.32–0.60%) among middle-aged to elderly smokers (median age 65 years, range 40–92 years).⁴ Among the 41 lesions, five that were larger than 3 cm were resected, and thymic epithelial tumor was identified in four of the five lesions, whereas five of 25 lesions (20%) smaller than 3 cm increased at 1 year. The Framingham Heart Study reported a prevalence of 0.89% (95% CI: 0.59–1.35% [23 of 2571 participants]) in a similar population (median age 59 years, range 35–92 years) except that half of the participants were non-smokers.⁵ None of the 23 lesions were resected, and six of eight lesions (75%) had increased on a follow-up CT scan over a median follow-up of 6.5 years. The latter study reported twice the prevalence of the former study, and the 95% CI of the prevalence did not overlap between the two studies. Meanwhile, the proportions of malignancy and interval growth in incidental anterior mediastinal lesions are still not conclusive.⁵

The aim of this study was to investigate the prevalence and characteristics of nodular lesions in the anterior mediastinum that had been incidentally found on screening chest CT in asymptomatic subjects.

Methods

Population

We retrospectively included consecutive asymptomatic participants who had undergone a baseline low-dose chest CT scan as part of their health checkups at the Center for Health Promotion of Seoul National University Hospital and Seoul National University Hospital Healthcare System Gangnam Center from 2006 through 2013. There were 56,358 participants (mean age 52.4 ± 10.5 years; male-to-female ratio 35,306:21,052), 11,310 of whom were from the former site and 45,048 of whom were from the latter site. Nearly half (44.4%) from the former site and 56.3% from the latter site had a history of ever smoking. This study was approved by our institutional review board (institutional review board approval No.1503-038-654), and the requirement for informed consent was waived.

CT Acquisition

Unenhanced chest CT scans were performed at a peak kilovoltage of 120 kV and a reference tube current of 20 to 50 mA using various multidetector CT scanners as follows: a four-channel row CT scanner (MX 8000, Philips Medical Systems, Cleveland, OH); an eight-detector row CT scanner (Light Speed Ultra, GE Medical Systems, Milwaukee, WI); a 16-detector row CT scanner (Sensation 16, Siemens, Erlangen, Germany); a 64-detector row CT

scanner (Brilliance 64, Philips Medical Systems and Somatom Definition, Siemens Medical Solutions, Forchheim, Germany); a 256-detector row CT scanner (Brilliance iCT 256; Philips Medical Systems); and a 320-detector row CT scanner (Aquillion ONE, Toshiba Medical Systems Corporation, Tokyo, Japan). Of the CT scans, 98.4% (55,484 of 56,358) were performed using 16- or more channel row CT scanners. The distribution of the number of CT scans was based on the number detectors. Patients were scanned craniocaudally from the lung apex to the costophrenic angle in the supine position at full inspiration during a single breathhold. All CT images were reconstructed with 3-mm or thinner slices along the axial plane, along with additional 1-mm slices in the axial plane on 16- or higher detector row CT scanners and a 3-mm slice in the coronal plane.

Identifying Nodular Lesions in the Anterior Mediastinum

Through the study period between 2006 and 2013, board-certified experienced chest radiologists read the chest CT scans. To check for the presence of nodular lesions in the anterior mediastinum, one author (S.H.Y.) searched the formal chest CT scan reports by combining keywords regarding locations and lesions: [anterior mediastin*] or [prevascular] or [thym*] and [lesion] or [nodule] or [mass] or [cyst]. We (S. H. Y. and J. M. G., with 10 and 24 years of experience in chest CT interpretation, respectively) reviewed CT scans from all extracted patients in consensus by using inclusion and exclusion criteria. We included nodular lesions with a short-axis diameter of 5 mm or longer in the anterior mediastinum between the thoracic inlet and the base of the pulmonary trunk along with the following margins: anterior margin, sternum; lateral margin, parietal mediastinal pleura; and posterior margin, anterior aspect of the pericardium. We excluded lesions that had typical CT features consistent with benign thymic lesions as follows: thymic remnant or hyperplasia, a midline lesion with triangular or quadrilateral shape in the center of the thymic bed partly or entirely containing fat attenuation intermingled in the area of soft-tissue attenuation, intrathoracic goiter, and soft-tissue lesion in the superoanterior mediastinum that retained a connection with thyroid gland.

Analyzing the CT Features

S. H. Y. measured the bidimensional long-axis and short-axis diameters by using an electronic caliper and assessed mean CT attenuation by drawing a round region of interest along the border of the anterior mediastinal lesion in the largest axial plane. The margin of the lesion was categorized as either well defined or ill defined. The shape of the lesion was categorized into three groups according to the ratio of the long- to the

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