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Features of Low-Dose Computed Tomography Scan Are Linked to the Annual Hospitalization Risk.

Eremy P. Stepan, Prakrut Nehta, David Srepeda, Shohit S

1. Department of Epidemiology and Biostatistics, University of Illinois Chicago, Chicago, Illinois
2. Department of Diagnostic Radiology and Nuclear Medicine
3. Rush University Medical Center, Chicago, Illinois

***Corresponding author**

Shohit S,
Department of Cardiovascular and Thoracic Surgery, Rush University Medical Center, Chicago, Illinois.

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ABSTRACT

History : This study set out to determine whether low-dose computed tomography (LDCT) screening for lung cancer might be used to pinpoint characteristics linked to a higher likelihood of hospitalization in the following year.
Methods : Individuals who had a follow-up of at least a year after a lung cancer screening performed between 2015 and 2020 weredetermined. Using body segmentation software, patient charts were reviewed in order to find traits that might be connected to injury and frailty in LDCT scans. Admissions for elective operations were omitted from the definition of hospitalization, which was defined as any stay longer than 48 hours within a year following the LDCT scan.
Results : 1606 LDCT scans satisfied the requirements for inclusion. The cohort's median age was 65 years (interquartile range: 61–70 years), with 54% of the participants being female (875/1606) and 50% of them currently smoking (804/1606).
With an interquartile range of 34 to 50 pack-years (median smoking history) of 40 pack-years. Within a year following the LDCT scan, there were 107 hospital admissions. Upon univariate analysis, the following conditions were shown to be associated with higher odds: emphysema (OR, 1.67; 95% CI, 1.09-2.56; P <.02), pulmonary artery enlargement (OR, 2.72; 95% CI, 1.09-6.62; P ¼.03), cardiomegaly (OR, 2.83; 95% CI, 1.33-6.04; P <.01), and coronary artery calcification (OR, 1.59; 95% CI,1.07–2.41; P [.02] were linked to a higher chance of hospitalization. Following age and sex control in multivariate analysis, higher odds of hospitalization were seen for cardiomegaly (OR, 2.41; 95% CI, 1.05-4.97; P [.03), emphysema (OR, 1.88; 95% CI, 1.19-2.93; P <.01), and body mass index >30 kg/m2 (OR, 1.55; 95% CI, 1.02-2.36; P [.04). When screening for lung cancer patients,Features that can be extracted from LDCT scans are linked to a higher chance of hospital admissions in the year that follows.

INTRODUCTION

Lung cancer, the most common cause of cancer-related mortality worldwide, was estimated to have caused 133,000 cancer deaths in the United States in 2022.1 Computed tomography at low dosage It has been demonstrated that (LDCT) lung cancer screening can detect early-stage tumors and lower lung cancer mortality2. Nevertheless, there is still much to learn about the possibility that LDCT scans can yield extra health-related data. Comprehending the possible additional benefits of LDCT could aid in the general uptake and retention of screening.Based on criteria from the US Preventive Services Task Force, an estimated 9 to 10 million people in the US are eligible for lung cancer screening.However, statistics indicate that between 5 and 20% of patients receive screening.3 Those who are eligible for lung cancer screening frequently have concomitant conditions that raise the expense and use of the healthcare system.

The two most often noted comorbidities in this population are cardiovascular disease and chronic obstructive pulmonary disease (COPD). An estimated $49 billion was spent in 2020 on COPD-specific medical treatments, with hospitalization accounting for 45–50% of the total expense.4 This patient population frequently has additional comorbidities such as diabetes, renal insufficiency, and interstitial lung disease, which makes patient management more difficult and raises health care utilization.Four studies have evaluated the LDCT's capacity to measure bone mineral density (BMD), emphysema, sarcopenia, and coronary artery calcification (CAC).5, 6 We speculate that radiographic characteristics that can be extracted from LDCT images may be linked to an annual risk of admission to a hospital. This information may enable early intervention and steps to lower hospital stays, lower medical costs, and increase the general uptake of lung cancer screenings.Materials and Approaches for Population Study. An institutional database was used to identify patients who received lung cancer screening between 2015 and 2020 and had at least a one-year follow-up.All patients satisfied the US Preventive Services Task Force's 2013 lung cancer screening requirements, which included being between the ages of 55 and 80, currently smoking or having stopped within the previous 15 years, and having smoked for at least 30 pack years. Patients who were lost to follow-up and those whose LDCT scans showed low image resolution as a result were excluded.in a partial collection of data. Every piece of information was deidentified and kept in an encrypted database.CHANGES. Covariates that suggested a connection to hospitalization or frailty were chosen for study based on earlier research.5,7 The definitions of all variables followed the guidelines set forth by the Society of Cardiovascular Computed Tomography, American College of Radiology, Fleischner Society, and Society of Thoracic Radiology. Age, sex, cardiomegaly, pulmonary artery diameter, skeletal muscle index (SMI), body mass index (BMI), BMD, emphysema, and CAC were the independent variables used for study. The electronic medical record and the radiologic diagnostic viewer (GE Centricity PACS Radiology) were used to gather patient data.RA1000 Workstation) and TomoVision sliceOmatic 5.0 rev 17.0, an image segmentation analysis program.A cardiothoracic ratio was used to define cardiomegaly.>0.5, which is determined by dividing the maximum thoracic width at the same level by the maximal cardiac width. The ratio of the pulmonary artery to the aortic diameter >1 was used to identify pulmonary artery enlargement. The software for segmenting images enabled the measurement of skeletal muscle using the usual muscle tissue attenuation range, which is between -29 HU and þ150 HU. It also gathered the cross-sectional area of muscle tissue. SMI was computed using the skeletal muscle cross-sectional area at T4.8. The SMI cutoff values for sarcopenia were <41 cm2/m2 for women, <43 cm2/m2 for men with a BMI of less than 25 kg/m2, and <53 cm2/m2 for males with a BMI of more than 25 kg/m2.7 BMI was classified as < 30 kg/m2 or > 30 kg/m2, which was consistent.with the classification of obesity as class I by the World Health Organization and the National Institutes of Health. Based on the lowest fully viewable vertebra in the sagittal plane, the diagnostic viewer was used to measure BMD at the >120 mg/cm3 threshold for normal set by the American College of Radiology.9 An elliptical region of interest situated in the trabecular region of the vertebral body was used to quantify BMD using LDCT.5. Emphysema and CAC severity was categorized as none, mild, moderate, or severe based on the standards listed in Table 1.The two categories for emphysema and CAC were mild or nonexistent (score of 1 or 0) and moderate or severe (score of 2 or 3). The variable that is dependant,Hospitalization was defined as an admission that occurred 48 hours within a year after the LDCT and was recorded in the primary institution's or the network's electronic medical record; admissions for elective procedures and any admission that had anything to do with screening for or diagnosis of lung cancer were not included. To reduce the number of single-day admissions that could not accurately reflect significant adverse health events that could be evaluated by LDCT, hospitalizations lasting less than 48 hours were eliminated. A thoracic radiologist verified all the information that needed to be interpreted based on imaging.A statistical examination.Radiographic and clinical characteristics linked to hospitalizations were found using univariate and multivariate logistic regression analysis. R (version 4.1) statistical software (R Foundation for Statistical Computing) was used to execute the statistical calculations.

OUTCOMES

Between 2015 and 2020, 1871 lung cancer screening scans were carried out. Out of them, 1766 out of 1871 (94%) satisfied the inclusion requirements, and 160 out of 1766 (9%) were not included in the study due to low-quality LDCT imaging. The analysis comprised 1606 LDCT scans from 1056 distinct patients in total. Since screening for lung cancer is done every year, some patients underwent several screening scans. The body composition information from each scan was combined and compared to hospital admissions that were documented for the year the screening was completed; As a result, a single patient may provide several distinct data sets. The interquartile age of the cohort's median was 65 years old.61–70 years old; Table 2). The percentage of females was slightly higher at 54% (875/1606). The group (804/1606) had a median smoking history of 40 pack-years, and 50% of them were current smokers. 107 hospitalizations (6.7% of scans) happened within a year after the LDCT imaging date during the research period. Hospitalizations were most frequently caused by cardiovascular disorders (congestive heart failure, acute coronary syndrome, peripheral artery disease [27/107]; Table 3) and respiratory diseases (COPD exacerbation, pneumonia, COVID-19 [28/107]). Univariate analysis revealed that severe emphysema (OR, 1.67; 95% CI, 1.33-6.04; P <.01) and cardiomegaly (OR, 2.83; 95% CI,hospitalization risk were pulmonary artery enlargement (OR, 2.72; 95% CI, 1.09-6.62; P ¼.03), severe CAC (OR, 1.59; 95% CI, 1.07-2.41; P ¼.02), and pulmonary artery enlargement (OR, 1.09-2.56; P ¼.02). Following multivariate analysis that adjusted for age and gender, the following factors were found to be independently associated with higher risk of hospitalization in the following year: cardiomegaly (OR, 2.41; 95% CI, 1.05-4.97; P ¼.03),

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severe emphysema (OR, 1.88; 95% CI, 1.19-2.93; P <.01), and BMI >30 kg/m2 (OR, 1.55; 95% CI, 1.02-2.36; P ¼.04). Only the initial LDCT scan obtained by each patient was analyzed as a sensitivity analysis, and the results showed that emphysema (OR, 2.14; 95% CI, 1.24-3.67; P <.01) was still present.While cardiomegaly (OR, 2.36; 95% CI, 0.92-5.46; P ¼.51) and BMI <30 kg/m2 (OR, 1.47; 95% CI, 0.88-2.46; P ¼.14) were no longer linked to hospitalization in the next year (SupplementalTable). The significance of a yearly screening is highlighted by the sensitivity analysis's findings.Observation This study found radiographic characteristics that can be extracted from LDCT scans and linked to hospitalization. Hospitalization in the next year was independently correlated with cardiomegaly, emphysema, and class I obesity or higher, even after adjusting for age and sex. On univariate analysis, hospitalization was associated with pulmonary artery enlargement and CAC; however, on multivariate analysis, this association was eliminated. Similarly, only the multivariate analysis showed a relationship between hospitalization and class I obesity.indicating that the ways in which these three variables interact play significant, if not entirely understood, roles in their links to hospitalization.

In order to determine the patients' risk of hospitalization, this study looked at LDCT data. Previous research showed that coronary artery calcium scoring in lung disease diagnosis with lung deformity Cardiovascular events and all-cause mortality can be independently predicted by cancer screening.In individuals undergoing lung cancer screening, 5,6 LDCT assessed bone density is independently correlated with all-cause death.5. Powerful prognostic markers that have been demonstrated to predict falls, fractures, postsurgical complications, and all-cause death include low skeletal muscle mass and sarcopenia.7. A higher risk of passing away is linked to the presence and severity of emphysema as determined by computed tomography-based visual categorization.10The study's findings imply that, similar to conventional computed tomography, lung cancer screening is not the only use for LDCT; it may also be utilized to gather more health-related data.This study has various restrictions. Image noise prevented the analysis of 9% of scans overall. The lungs are accurately assessed thanks to LDCT methods.

However, some of the covariates in our analysis—like SMI and BMD—are not commonly measured in the screening process for lung cancer, and image noise made it difficult to get accurate readings from a small number of scans. This study only includes patients from one particular institution. Although individuals undergoing lung cancer screening share similar medical histories related to age and smoking history, the external validity of the results could be enhanced by a large-scale, multicenter study involving diverse parts of the nation.The findings of this investigation show a relationship between the annual risk of hospitalization and radiographic characteristics obtained from LDCT scans. In the end, LDT scans may provide physicians with an efficient and powerful screening instrument for a variety of health-related outcomes in addition to lung cancer detection. Clinicians may be more inclined to offer lung cancer screening for eligible patients and to encourage screening uptake and follow-up if they obtained more health-related information from LDCT scans. Considering that LDCT scans are inexpensive, fast to read and interpret, and involve very little radiation, further research should be done on their potential applications outside of lung cancer screening.

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