2020

Low Dose Computed Tomography and Lung Cancer

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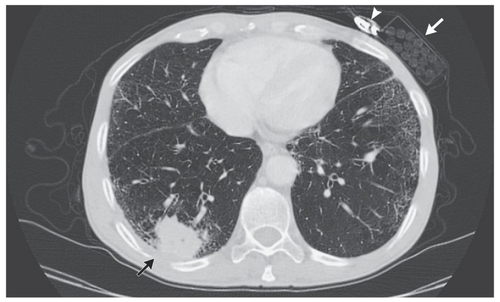
Introduction

Lung cancer is the second most common form of cancer in the United States. Smoking is the primary cause of lung cancer, accounting for 85%-90% of all lung cancer deaths (Rulli & Matthews, 2020). There are two types of lung cancer:

- Non small cell lung cancer (NSCLC)
  - Adenocarcinoma- occurs in current or former smokers; found in outer portion of the lungs.
  - Squamous cell carcinoma- caused by history of smoking; found in central part of lungs by airway.
  - Large cell carcinoma- can grow and spread rapidly; found in any portion of the lung.
- Small cell lung cancer (SCLC).
  - About 10% to 15 of all lung cancers are SCLC (American Cancer Society, n.d.).
  - Grows and spreads faster than NSCLC.



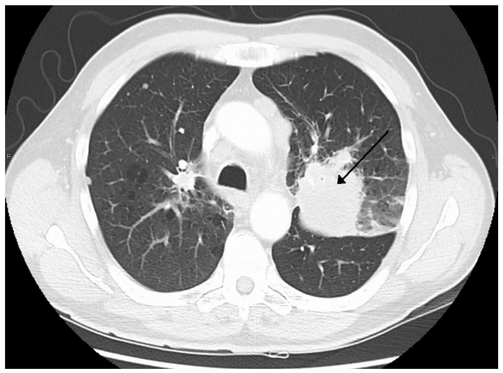
Black arrow indicating squamous cell carcinoma of the right lung. (Dayo, 2018).

Computed Tomography

- Computed tomography (CT) is a noninvasive imaging test.
- Creates cross sectional images of organs, bones, soft tissue and blood vessels.
- The images generated during a CT scan can be reformatted in multiple planes and generates three dimensional images (RadiologyInfo.org, n.d.).
- CT scans are often preferred as it can detect many types of cancers.

What is Low Dose Computed Tomography (LDCT)?

- Patients who have a high chance of lung cancer may undergo a LDCT scan.
- LDCT uses a unique CT scan protocol that produces images of sufficient quality to detect many abnormalities while using up to 90% less ionizing radiation than a standard Chest CT (RadiologyInfo.org, n.d.).
- National Comprehensive Cancer Network (NCCN) suggest the use of LDCT screenings for early lung cancer detection (Gjermundson & Clark, 2019).
- To be considered low dose, the effective dose for CT must be 1.5 millisieverts (mSv), compared to 7 mSv for a regular chest CT (Rulli & Matthews, 2020).
- The effective dose is defined as overall long-term risk of radiation exposure from examinations or procedures (Rulli & Matthews, 2020).
- LDCT scans is the preferred technology of choice to detect lung cancer early.
- LDCT scans can visualize small tumors that are unseen on traditional chest x-rays (Rulli & Matthews, 2020).
- LDCT has a higher sensitivity and specificity for early lung cancer detection than chest radiography and sputum cytology (Rulli & Matthews, 2020).
- Chest CT scans can detect nodules less than 1 cm in diameter (Komaki, Roth, & Ki Hong, 2014).



Non-small cell lung carcinoma in upper lobe of left lung. (Heilman, 2017).

Patient Demographics

In order to qualify for a LDCT, the patient must meet the following criteria:

- Age- must be 55 to 80 years old (Gjermundson & Clark, 2019).
- Male/Female- Males are more likely to smoke (Rulli & Matthews, 2020).
- Ethnicity- All ethnicities are eligible, however African American men are more likely to die from lung cancer (Rulli & Matthews, 2020).
- Smoking History- Patients who have a 30 pack-year smoking history, currently smoke or have quit within the past 15 years (Gjermundson & Clark, 2019).

It is important to target high risk populations such as sexual minorities. Sexual minorities, who identify as lesbian, gay, bisexual, transgender (LBGT) are at a greater risk of smoking and tobacco use disorders than heterosexuals (Veliz et al., 2019). The odds of LBGT community indicating eligibility for LDCT screenings were higher than heterosexuals.

Smoking Cessation

Smoking Cessation programs are highly effective and reduce the lung cancer risk. An analysis of historical data that compared the benefits of smoking cessation and lung cancer screening found that smoking cessation would have resulted in reduced mortality more than 2 times that of LDCT screenings (Gjermundson & Clark, 2019).

Smoking cessation can improve pulmonary function and circulation within 2 weeks to 3 months after quitting (Komaki, Roth, & Ki Hong, 2014). 1-9 months the ciliary function of the lung epithelium is restored; might experience increased coughing as lungs clear mucus (Komaki, Roth, & Ki Hong, 2014). After 5-15 years the risk of a stroke is reduced; chance of dying of lung cancer is approximately half that of continuing smokers (Komaki, Roth, & Ki Hong, 2014).

Benefit

The National Cancer Institute confirmed LDCT can detect lung cancer early in some patients. When detected early it increases the chance of survival and treatment options for patients with lung cancer (Rulli, & Matthews, 2020).

Risks

A major concern regarding Lung Cancer Screenings is the associated risk for radiation-induced cancer (Perisinakis et al., 2018). Patient radiation burden from LDCT scans of the chest has been reported in several studies in terms of effective dose derived through the dose length product (Perisinakis et al., 2018). LDCT is estimated to have an effective radiation dose of approximately 1.5 mSv per annual exam, whereas a diagnostic chest CT has an effective dose of 8 mSv (Komaki, Roth, & Ki Hong, 2014).

False positives are possible resulting in unnecessary tests for the patient. Additional testing can increase radiation dose and financial cost. Approximately 75% of the scans in the NLST trial were normal, the false-positive rate was about 24% (Gjermudson & Clark, 2019).

Non- calcified nodules (NCNs) can be discovered with false positive LDCT screenings for lung cancer have been attributed to various cases, including infectious and inflammatory processes (Pinski & Gierada, 2020). NCNs may indicate a precursor for lung cancer

CT scans shows spiculated nodule in right upper lobe. (Radiology Key, 2016).

Incidental findings can occur when LDCT scans are performed. This can lead to further testing, 73% of the NELSON trial suggested 1 nonclinical relevant incidental finding, such as pulmonary fibrosis, emphysema, and enlarged lymph nodes (Gjermudson & Clark, 2019).

Conclusion

LDCT scans are important for patients who are at high-risk for lung cancer. Studies have indicated LDCT scans can detect lung cancer early, which can impact the survival rate. To be considered for a LDCT scan patients meet specific requirements such as age and smoking history.

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