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Low-Dose Computed Tomography & Lung Cancer Screening

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Introduction

Computed tomography (CT) involves a x-ray tube rotating around a patient's specific body part that is being examined (Long, Rollins, & Smith, 2019, p. 206). As a result of this, cross-sectional tomographic plane is created and images can be displayed into a cross-sectional format (Long et al., 2019, p. 206).

Equipment (Long et al., 2019, p. 213).

- Computer, provides link between the technologist and the other components of the imaging system.
- Gantry, circular device that houses and rotates x-ray tube.
- Table, holds patient in desired position for image acquisition.
- Operator's Console, where the technologist controls the scanner.

Different Plane Reformats (Long et al., 2019, p. 217)

- Created by stacking multiple contiguous axial images which creates a new volume of data.
- Coronal, reformats go anterior to posterior.
- Sagittal, reformats go lateral to medial.

Radiation & Patient Protection (Long et al., 2019, p. 233)

- Due to exposure parameters, a higher entrance skin dose than exit skin dose is produced which creates a large dose gradient across the patient.
- To reduce dose, machine has off-focal radiation suppression devices, beam shaping filters & z-axis efficiency with increased collimation.

- Image of a CT of the chest with the arrow pointing to a lung nodule (Saltybaeva, Martini, Frauenfelder, & Alkadhi, 2016).

Low-Dose Computed Tomography (LDCT)

LDCT is simply a CT scan with a significantly lower dose, still able to have a diagnostic reading done on it (Nawa, 2018, p. 1441).

- Can reduce tube current down to 40 mAs (Saltybaeva et al., 2016).
- Estimated effective dose down to 1- 1.5 mSv per exam (Saltybaeva et al., 2016).

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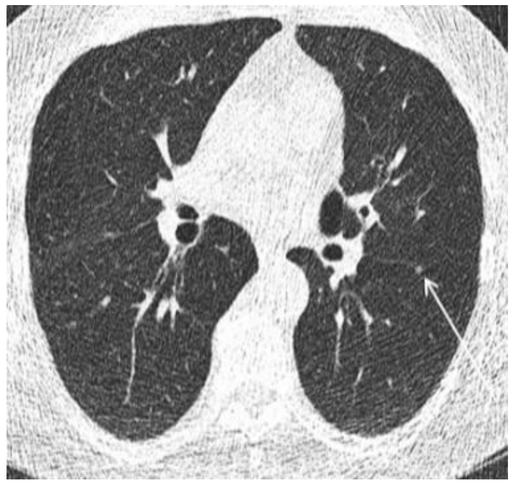


- CT of the chest done using LDCT for a lung cancer screening where a nodule was found indicated by the arrow (Saltybaeva et al., 2016).

Lung Cancer Screenings with LDCT

- Lung cancer is the most common type of cancer in the world (Wei et al., 2020, p. 1225). LDCT has shown a survival benefit with a 20% reduction in mortality from lung cancer (Saltybaeva et al., 2016).
- Questionnaires used to determine people who qualify as a high risk for lung cancer and should be screened (Wei et al., 2020, p. 1225).
- Questionnaires include asking patients if they are a male or female, smoker, education, chemical exposure, and family history of lung cancer (Wei et al., 2020, p. 1224).
- LDCT lung cancer screening showed a 4 to 8 year mortality decrease in a study done in Hitachi City, Japan after being implemented (Nawa, 2018, p. 1443).
- LDCT lung cancer screenings also had a success performance in Gejiu, Yunnan (Wei et al., 2020, p. 1224).

Physicians' Views on LDCT

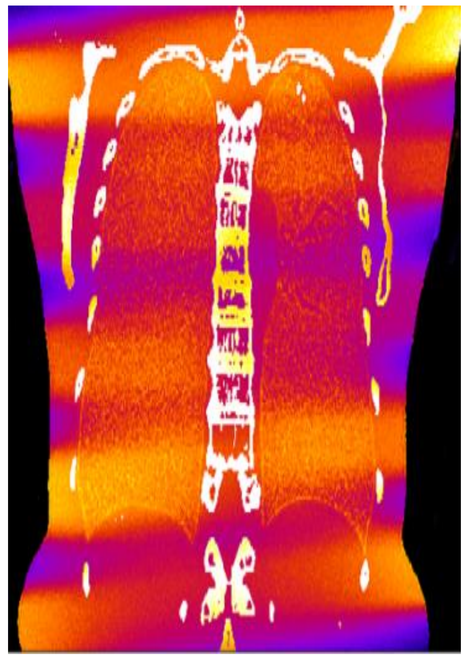
A national survey was done by lung cancer specialists regarding views on LDCT lung cancer screenings done in Korea (Shin et al., 2018, p. 1). This group included pulmonologists, thoracic surgeons, medical oncologists, and radiological oncologists (Shin et al., 2018, p. 3). These specialists have a history of providing direct care to lung cancer patients and their families (Shin et al., 2018, p. 3).

- Study found that 100% of the lung cancer specialists agreed that LDCT increases early detection and survival rates 95.1% (Shin et al., 2018, p. 4).
- Also found that LDCT lung cancer screenings gave them a good opportunity to try and get people to stop smoking (Shin et al., 2018, p. 4).
- It was found that 79.8% of the specialists think that the false positives are too high and false positives can cause psychological distress and physical harms (Shin et al., 2018, p. 4).
- A negative test result was also viewed by some specialists to give patients false reassurance that they could still continue to smoke (Shin et al., 2018, p. 4).

Problems with LDCT

Although LDCT lung cancer screenings has its benefits, there are also some problems. There is still an ongoing debate on the radiation dose from LDCT lung cancer screenings and how it can influence future development of radiation-induced lung cancer (Saltybaeva et al., 2016). This is especially important for individuals who are routinely getting these exams as part of an annual lung cancer screening test, thus increasing cumulative dose of radiation from repeated CT examinations (Saltybaeva, et al., 2016).

- There was a high false positive rate from a study done by the National Lung Screening Trial Research Team where the rate was up to 26.6% (Nawa, 2018, p. 1443).
- A false positive result would require additional scans to be done on the patient thus turning the relatively low-dose from these screenings into a potential high cumulative radiation dose as a result (Saltybaeva, et al., 2016).
- A screening that comes back negative for lung cancer might give people false reassurance they could continue to smoke or could cause people who quit to start smoking again (O'Dowd & Baldwin, 2017).



- The image above shows the distribution of radiation dose to the surrounding tissues and structures from a CT of the chest coronal reformat. The areas in blue and purple are when dose was the lowest where areas represented by red and orange show where the dose was the highest (Saltybaeva et al., 2016).

Conclusion

The use of LDCT lung cancer screenings has become more popular as the years go on and better technology is developed. LDCT lung cancer screening allows for the chance to detect lung cancer; which is the most common type in the world, at an early stage where it has the best chance of being cured. Individuals who undergo LDCT lung cancer screenings should be selected through a questionnaire that determines if they are at high risk for developing lung cancer.

Although LDCT has these benefits, it still has problems with the radiation dose, false positive readings of lung nodules, and what group of people should be receiving these screenings. A false positive result can have devastating effects on a person's mental health, and cause them to avoid future treatments as a result. More research is needed on this topic in order to develop a better protocol that could be used for these LDCT lung cancer screenings. Radiation dose should also be reduced as low as reasonably achievable in order to reduce the chances for any radiation induced cancers.

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