The Expanding Role of CT Lung Screening

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CT Lung Screening

Among all cancers, lung cancer is the leading cause of cancer deaths worldwide. In the United States alone, lung cancer accounts for 28% of all cancer deaths.[1] In 2002, the National Lung Screening Trial (NLST) began screening individuals through the use of either computed tomography (CT) or by a chest radiograph. This trial offered screenings at specific times, an initial baseline and two annual screenings to follow.[2] The initial trial reduced mortality by 20%, but offered a false positive rate of 26.6%. [3] In 2014, the American College of Radiology (ACR) standardized the reporting and management of discovered lung nodules to reduce false positive reporting down to 13%.[4]

Advances in helical CT scanners have allowed for increased visualization of potential abnormalities over conventional radiograph. In addition to the NLST, improvements have been made to lower the overall radiation dose of lung cancer screenings.[5] These low dose scans (LDCT) are now commonly utilized in lung cancer screening protocols (see Image 1).

Currently, LDCT is utilized in China to screen for lung cancer for not only those with key risk factors such as older age and a history of smoking but also for individuals as young as 35 with no smoking history. Of the 14,506 participants without a smoking history, lung nodules were detected in 4,336 of these individuals. And of those 4,336, 178 were diagnosed with lung cancer by surgery or biopsy.[6]

Screening Other Cancers

The success of LDCT lung screenings is not limited to patients with lung cancer as their primary diagnosis. Low dose CT screenings have also positively impacted patients with previously treated head and neck squamous cell carcinoma (HNSCC). A 2018 study set out to examine the value of utilizing CT screening of the head, neck, and chest for reoccurring HNSCC. While there were no found cases of recurrent cancer detected on the head and neck CT scans, the lung screening scans discovered reoccurring cancer in 8 of 15 patients. Due to these findings, researchers recommend utilizing CT of the head and neck at 6-months post-treatment as one-time imaging, and low-dose chest CT done annually as surveillance.

Artificial Intelligence

Artificial intelligence (AI) is becoming more common in the lexicon, including the medical imaging world. AI's anticipated use in imaging, specifically cancer imaging, will include detection, characterization, and monitoring.

The implementation of AI in CT lung screening has shown promise in determining malignancy. Clinical trials from Oxford University assessing lung cancer prediction software. The software utilized NLST data as a baseline; this is often referred to as 'deep learning.' Using this data the AI software produced results described as comparable to the NLST data. In order to close the gap between the NLST data results and AI CT lung screening the system will require some improvements but early results are promising.[8]

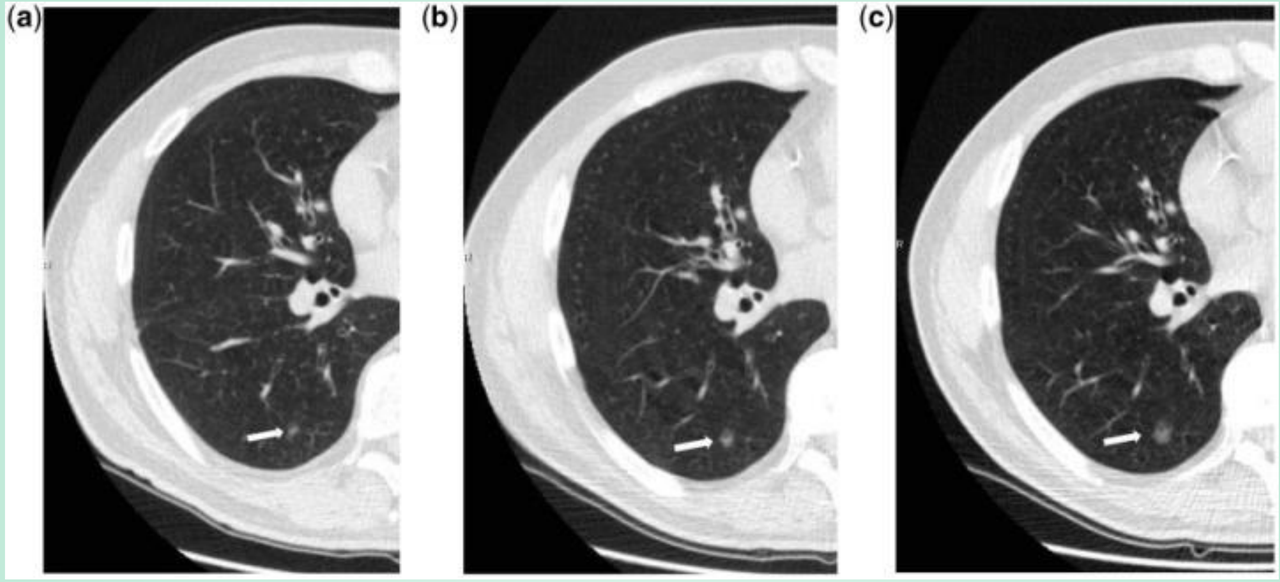

Image 1. Transverse unenhanced low-dose CT scans show a slow-growing pulmonary nodule of the lower right lobe in a 61-year-old man. In 2012, the nodule was surgically removed and was found to be adenocarcinoma of the lung. The nodule measured 5.5 mm in 2007 (a), 8.5 mm in 2009 (b) and 11 mm in 2012 (c).[5]

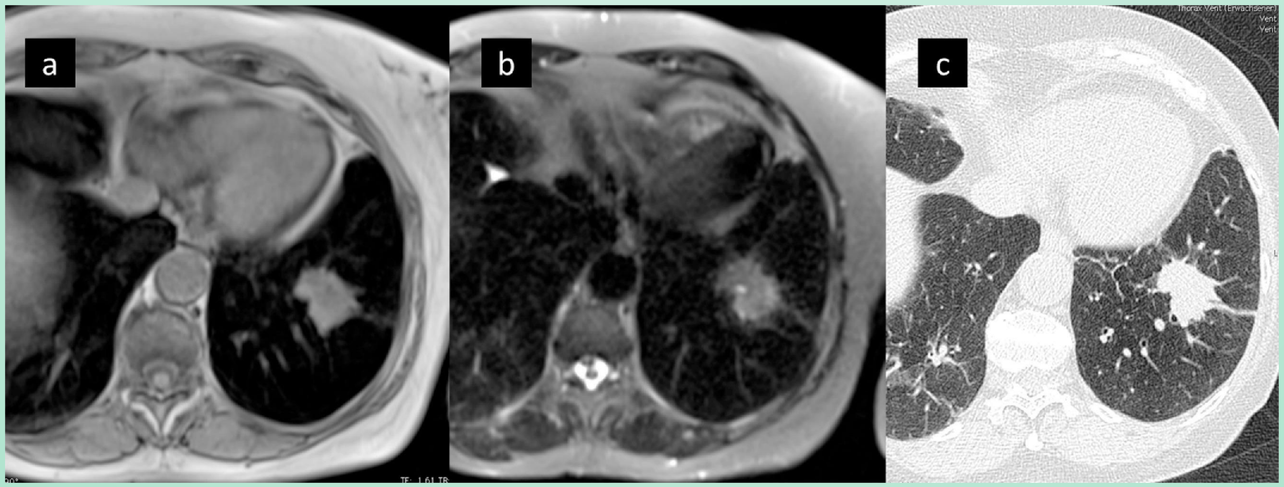

Image 2. Lung cancer of the left lower lobe as an incidental finding in a 70 y old participant of a COPD imaging study. 3D-GRE (a), inversion recovery T2-half-Fourier-FSE (b) and LDCT-scans (c); 1.5 T MRI[9]

A Magnetic Future

Magnetic resonance imaging (MRI) may provide a radiation-free alternative to lung cancer screening (see Image 2). Recent studies have already set the false positive rate for MRI lung cancer screening far lower than that of LDCT. The NLST first round screenings reported a false positive rate of 23.3% while early MRI screenings have reported a much lower false positive rate of 5%.[9]

It has yet to be determined how MRI will be incorporated into clinical lung cancer screening, though it has shown early promise. Whether it replaces LDCT or become another part of the screening routine has yet to be determined.

Conclusion

Computed tomography has proven to be a valuable preventative screening tool for lung cancer. Not only for patients with high-risk factors but also for low-risk patients as well.[6] Additionally, new research has shown promise utilizing CT for other cancer screenings, such as HNSCC.[7]

With lung cancer being so prevalent it is important to continue to develop new advancements in technology such as AI and continue to improve upon them. Using additional imaging modalities such as MRI to detect lung cancer will add another dimension to the standard of care for detection and monitoring. Only by taking advantage of all available technologies will detection rates increase and the instance of false positives be reduced. These more accurate diagnosis and treatment plans will lead to improved patient outcomes.

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