Mini Review
Open Access
CrossMark

The role and place of ultra-low-dose CT examination in the diagnosis of the chest area

Volume 12 Issue 1 - 2025

Tortladze Irakli, Urushadze Otar, Nemsadze Grigol, Aphkhazava Giorgi, Liparteliani Nugzar
Department of Radiology, Tbilisi State Medical University, Georgia

Correspondence: Tortladze Irakli MD, Assistant professor, Department of Radiology, Tbilisi State Medical University, Georgia, Tel +995598262701, Email Iraklitortladze@yahoo.com

Received: January 20, 2024 | **Published:** February 03, 2025

Keywords: radiation, ultra-low- dose, chest CT

Introduction

Digital chest X-ray radiography (CXR) is commonly the initial imaging technique used to detect chest pathologies due to its accessibility and efficiency. However, as a two-dimensional (2D) projection technique, CXR is limited by structural superposition, which can lead to diagnostic inaccuracies, including false-positive and false-negative results. Both phantom and patient studies have shown that three- dimensional (3D) computed tomography (CT) improves diagnostic confidence and accuracy compared to CXR.

However, the traditionally higher radiation dose associated with CT scans has been a significant drawback when compared to CXR, which has a mean effective dose of approximately 0.10 mSv, as per European surveys. Standard chest CT delivers a dose approximately fifty times higher, averaging around 5.5 mSv. Recent studies suggest that ultra-low-dose CT (ULDCT), achieving doses below 1 mSv, may detect various chest conditions with diagnostic accuracy comparable to traditional CT methods, but with a radiation dose close to that of CXR. This study hypothesizes that ULDCT may offer a more reliable diagnosis across a range of chest pathologies, enhancing detection capabilities while minimizing radiation exposure.

Methods

Each patient underwent a CXR prior to an additional ULDCT examination. The ULDCT field size was customized per patient, and scanograms were omitted to reduce radiation exposure. Instead, the scanning range was set manually from the lung apex to the diaphragm using traditional laser guidance.

Results

In cases where CXR results differed from ULDCT, the ULDCT often had a significant impact on patient.

Discussion

Lung nodules are often discovered incidentally during routine screenings, and the ability to accurately assess them is critical for early detection and management, especially for malignancies. However, repeated standard-dose CT scans pose potential cancer risks due to cumulative radiation exposure. Recommendations from the International Commission on Radiological Protection (ICRP) indicate that every 1 mSv increment raises lifetime cancer risk by 0.005%, highlighting the importance of low-dose protocols.

ULDCT scanning, with dose-modulating techniques such as lowering the tube voltage to 80 kV and current, achieves significant radiation reductions, allowing safe and effective imaging with quality comparable to standard CT scans. In this study, ULDCT maintained diagnostic accuracy without notable artifacts, suggesting its feasibility for accurate lung nodule assessment in long-term follow-up patients requiring periodic chest imaging.

Conclusion

This study demonstrates that ULDCT, when used at a radiation dose comparable to CXR, provides an improved diagnostic yield and confidence over CXR alone for chest pathology assessment. The clinical impact of ULDCT is evident in its ability to detect pathologies missed on CXR, to rule out suspected abnormalities, and to support high-confidence diagnoses that influence patient management, including treatment adjustments and follow-up frequency.

This technique shows promise for broader clinical application, particularly given the low effective dose range of 0.011–0.8 mSv achievable with ULDCT, which is well below the effective dose of conventional chest CT. Enhanced by modern dose-reduction methods like current modulation and iterative reconstruction, ULDCT may serve as a practical and safer imaging option for patients requiring frequent follow-up scans (Figure 1).[1-3]

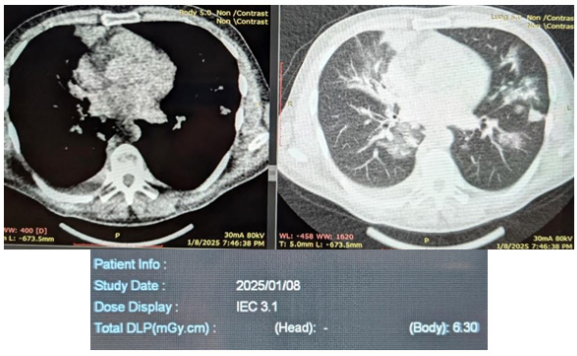

Figure 1 ULDCT, with a radiation dose comparable to CXR.

Acknowledgments

None

Conflict of interests

All authors declare that there is no conflicts of interest.

References

1. Gordic S, Morsbach F, Schmidt B, et al. Ultralow-dose chest computed tomography for pulmonary nodule detection: first performance evaluation of single energy scanning with spectral shaping. *Invest Radiol*. 2014;49(7):465–473.
2. Khawaja RDA, Singh S, Madan R, et al. Ultra-low dose chest CT using filtered back projection: comparison of 80-, 100- and 120 kVp protocols in a prospective randomized study. *Eur J Radiol.* 2014;83(10):1934–1944.
3. Copley SJ, Coren M, Nicholson AG, et al. Diagnostic accuracy of thin--section CT and chest radiography of pediatric interstitial lung disease. *AJR Am J Roentgenol*. 2000;174(2):549–554.