Advances in Precision Medicine, 2026, Volume 11, Issue 8
https://bbwpublisher.com/journal/APM
Online ISSN: 2424-9106
Print ISSN: 2424-8592

Diagnostic Value and Risk Assessment of Low-dose CT Scanning Technology in Lung Cancer Screening

Jing Liu*

Zhangjiagang Jianhua Hospital, Suzhou 215600, Jiangsu, China

Author to whom correspondence should be addressed.

Copyright: © 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: *Purpose:* To evaluate the diagnostic value and risk of low-dose CT scanning technology in lung cancer screening. *Methods:* Lung cancer patients who underwent CT examinations in private secondary hospitals from 2024.1 to 2025.12 were included. The total sample size was 40 cases. According to different scanning plans, the patients were divided into a low-dose group and a conventional-dose group, 20 cases each. The differences in radiation dose and image quality scores between the two groups were evaluated. *Results:* A total of 35 pulmonary nodules were detected in the low-dose CT group and 39 in the conventional-dose CT group. The difference in detection type and size distribution of nodules between the two groups was small, $P > 0.05$. The CT dose index, dose length product, and effective dose of the low-dose group were lower than those of the conventional dose group, $P < 0.05$. There were small differences in the subjective scores of image quality and noise, signal-to-noise ratio, and contrast-to-noise ratio between the two groups, $P > 0.05$. *Conclusion:* In the diagnosis and screening of lung cancer patients, low-dose CT scanning technology can reduce radiation dose while ensuring detection and image quality, and has the potential to replace conventional dose.

Keywords: Lung cancer patients; Diagnosis; Screening; Low-dose CT scanning technology; Radiation dose

Online publication: August 26, 2026

1. Introduction

Pulmonary malignant tumors have always ranked first in the domestic malignant tumor incidence statistics. Patients in the early stages generally do not experience obvious physical discomfort. When most people feel a persistent cough or chest pain, the lesions have developed to the mid-to-late stage, and the corresponding long-term survival level will be significantly reduced at this time [1]. The use of imaging methods for large-scale population screening can increase the proportion of early lesion identification. Traditional chest X-rays have the problem of insufficient resolution. Small ground-glass lesions are difficult to completely identify through ordinary chest X-rays. Multi-slice spiral CT can capture millimeter-level soft tissue changes in the

lungs and has long been used as the main method for screening lung lesions [2]. Conventional parametric CT scans will produce a high degree of ionizing radiation, and repeated examinations will lead to accumulation of radiation, which will increase the risk of damage to human cells. In the case of large-scale universal screening, such safety risks will continue to expand [3]. Primary medical institutions are responsible for screening residents for lung lesions. The age span of the patients is relatively large. Middle-aged and elderly people need to undergo regular lung re-examinations. The problem of radiation accumulation caused by repeated CT examinations cannot be ignored. After the imaging equipment was updated, the reconstruction algorithm supporting low-dose scanning was promoted [4]. This mode controls radiation output by reducing scan tube current and utilizes novel reconstruction methods to reduce image sharpness loss. At present, primary medical institutions have not accumulated much practical data on low-dose chest scanning. The number of clinical observation samples for simultaneous comparison of the two scanning modes is small. There is no unified reference basis for the actual changes in nodule identification ability and objective image indicators caused by different dose settings. This article selects patients who are treated in the hospital and have indications for lung screening, and uses two sets of scanning parameters to collect images at the same time, compare the radiation output level and comprehensive image performance, and provide a real clinical reference for grassroots hospitals to choose CT scanning programs suitable for lung cancer screening.

2. Materials and methods

2.1. General information

From 2024.1 to 2025.12, 40 lung cancer patients who underwent CT examinations in private secondary hospitals were taken as the research subjects. According to the different scanning plans, the patients were divided into a low-dose group and a conventional-dose group, with 20 cases in each. In the low-dose group (n = 20), there were 11 males and 9 females; the age range was 58-80 years old, with an average age of (69.35 ± 5.42) years; in the conventional-dose group (n = 20), there were 10 males and 10 females; the age range was 58-80 years old, with an average age of (68.01 ± 5.13) years. The baseline data of the two groups were balanced, $P > 0.05$.

Inclusion criteria: Complete the chest CT scan process; have clinical manifestations related to lung abnormalities such as cough, chest tightness, and hemoptysis, and have indications for lung cancer screening; age range is 58 to 80 years old; normal cognitive status and can cooperate with the breath-holding position for scanning; voluntarily participate in this study.

Exclusion criteria: those who have received chest radiotherapy within 3 months before scanning; those with severe thoracic deformity who cannot standardize the scanning position; those with severe cardiopulmonary failure who cannot complete the breath-holding operation; those with large-area motion artifacts in the image that cannot carry out nodule interpretation; those with a history of contrast agent allergy who cannot cooperate with the enhanced scan-related procedures; those for whom the examination was abandoned midway or the data is incomplete.

2.2. Method

All patients were uniformly scanned using multi-slice spiral CT equipment for chest scanning, with the scanning range extending from the lung apex to the level of the bilateral adrenal glands. Breathing training was completed before the examination, and patients were instructed to maintain a breath-holding state after

deep inhalation throughout the scanning process to reduce the interference of motion artifacts on image interpretation. All scanned original images are simultaneously transmitted to the imaging workstation, and two radiologists who have been practicing for more than five years independently complete the readings. The two radiologists do not know each other's group information and implement a double-blind interpretation mode.

The scanning parameters of the low-dose group were set as tube voltage 120 kV, tube current 40 mA, pitch 1.0, reconstruction layer thickness 1 mm, reconstruction interval 0.5 mm, and an iterative reconstruction algorithm was used to complete image post-processing;

The scanning parameters of the conventional dose group were set as tube voltage of 120 kV, tube current of 120 mA, pitch of 1.0, reconstruction layer thickness of 1 mm, and reconstruction interval of 0.5 mm. The filtered back-projection reconstruction algorithm was used to complete image post-processing.

2.3. Observation indicators

The detection status of pulmonary nodules and the maximum diameter of the nodules were counted and compared between the two groups; the radiation doses of the two groups were compared, including CT dose index, dose length product, and effective dose; the image quality scores of the two groups were compared. The objective scores were noise, signal-to-noise ratio, and contrast-to-noise ratio. The subjective scores were evaluated on a 5-point scale and were evaluated by two radiologists in a double-blind manner.

2.4. Statistical methods

The calculation software used for relevant data is SPSS 27.0. The measurement data are described as mean ± standard deviation (SD). The independent-samples t-test is used for comparison between the two groups. The count data are expressed as frequencies and constituent ratios, and the chi-square test is used. $P < 0.05$ was considered a statistically significant difference.

3. Results

3.1. Compare the detection status of pulmonary nodules between the two groups

A total of 35 pulmonary nodules were detected in the low-dose CT group and 39 in the conventional-dose CT group. The difference in detection type and size distribution of nodules between the two groups was small, $P > 0.05$. See **Table 1** for details

Table 1. Comparison of pulmonary nodule detection status (n, %, mean ± SD)

Group	n	Total number of nodules detected	Solid nodule	Partially solid nodule	Ground-glass nodules	Maximum diameter of nodule (mm)
Low dose group	20	35	18 (51.43%)	10 (28.57%)	7 (20.00%)	8.35 ± 3.12
Regular dose group	20	39	20 (51.28%)	12 (30.77%)	7 (17.95%)	8.51 ± 3.28
χ^2		--	0.000	0.043	0.051	0.122
P	--	--	0.990	0.836	0.822	0.904

3.2. Compare the radiation dose between the two groups

The CT dose index, dose length product, and effective dose of the low-dose group were lower than those of

the conventional dose group, $P < 0.05$. See **Table 2** for details

Table 2. Radiation dose comparison (mean ± SD)

Group	n	CT dose index (mGy)	Dose length product (mGy·cm)	Effective dose (mSv)
Low dose group	20	3.23 ± 0.65	156.78 ± 28.34	4.35 ± 0.43
Regular dose group	20	6.11 ± 1.12	243.46 ± 45.67	9.41 ± 0.69
t	--	-9.95	-7.21	-27.83
P	--	<0.001	<0.001	<0.001

3.3. Compare the image quality scores of the two groups

There were small differences in the subjective scores of image quality and noise, signal-to-noise ratio, and contrast-to-noise ratio between the two groups, $P > 0.05$. See **Table 3** for details

Table 3. Comparison of image quality scores (mean ± SD)

Group	n	Subjective rating (points)	Objective indicators (points)		
			Noise (HU)	Signal-to-noise ratio	Contrast-to-noise ratio
Low dose group	20	4.15 ± 0.49	12.34 ± 2.15	8.67 ± 1.32	5.43 ± 1.01
Regular dose group	20	4.40 ± 0.50	11.02 ± 1.98	9.45 ± 1.41	6.02 ± 1.12
t	--	1.597	2.020	1.806	1.750
P	--	0.119	0.051	0.079	0.088

4. Discussion

The early lesions of lung malignant tumors are small in size and will not cause significant compression of tissues such as the bronchus and pleura, and patients will not show typical abnormal sensations. The lesions in most diagnosed patients are already accompanied by local infiltration or distant metastasis at the time of diagnosis, and the corresponding five-year survival rate will be significantly reduced [5]. The main direction to improve the overall diagnosis and treatment effect of lung malignant tumors is to expand the coverage of early screening and timely detect micro-nodular lesions that have not yet progressed. The soft tissue resolution of ordinary chest plain films is limited, and ground-glass changes less than 10 mm or solid lesions hidden next to the mediastinum and behind the ribs are easily missed [6]. Multi-slice spiral CT uses the principle of tomographic imaging to eliminate observation blind spots caused by tissue overlap and can clearly distinguish small lung nodules of different densities. It is the main imaging tool for screening lung lesions. Multi-slice spiral CT uses X-rays to pass through the human chest tissue. Lung structures with different densities absorb the rays to different degrees. The detector receives the attenuated ray signals, and the back-projection algorithm converts them to generate tomographic grayscale images. Doctors judge the changes in soft tissue morphology based on the grayscale differences in the images. There are currently two practical problems in lung cancer screening in grassroots hospitals [7]. Conventional dose CT can ensure stable image quality, but the radiation dose is high. The low-dose mode has a good radiation protection effect, but primary medical staff feel that the poorer image clarity will cause small nodules to be missed. There is relatively little comparative data between these two scanning schemes, and doctors lack a practical reference basis when making clinical choices [8]. There are differences in tube current settings and image

reconstruction methods between the two scanning modes, but parameters such as coverage, layer thickness, and pitch of other scans remain consistent. The conventional dose uses a 120 mA tube current and is combined with filtered back-projection reconstruction. The original image acquisition signal is relatively sufficient, the image noise value is low, and objective indicators such as signal-to-noise ratio and contrast-to-noise ratio show certain advantages. Adjusting the tube current to 40 mA in low-dose mode will reduce the total radiation output. An iterative reconstruction algorithm denoises low-signal original images to reduce graininess. There is only a slight decrease in the final image clarity, which will not affect the discrimination and judgment of small lung nodules. The main advantages of the low-dose program in terms of radiation control are that all types of radiation measurement-related indicators in a single examination have dropped significantly, the cumulative radiation risks of repeated screening groups have been effectively mitigated, and the safety advantages of long-term group screening will continue to be reflected. This article simultaneously collects image-related indicators under the two scanning modes to objectively compare nodule detection capabilities, radiation levels, and comprehensive image performance to determine the actual adaptability of low-dose CT in primary lung cancer screening scenarios.

The results showed that a total of 35 pulmonary nodules were detected in the low-dose CT group and 39 in the conventional-dose CT group. The difference in nodule type and size distribution between the two groups was small, $P > 0.05$. The CT dose index, dose length product, and effective dose of the low-dose group were lower than those of the conventional-dose group, $P < 0.05$. There were small differences in the subjective scores of image quality and noise, signal-to-noise ratio, and contrast-to-noise ratio between the two groups, $P > 0.05$. From all the image-related data collected during this observation, it can be seen that there is no obvious difference in the overall number of various types of pulmonary nodules, nodule classification composition, and average diameter of lesions identified by the two sets of scanning plans. Small solid or ground-glass lesions can be fully displayed, and the low-dose setting will not increase the probability of missing small nodules. The subjective scoring of the images was completed independently by two radiologists. There was only a small difference in the mean scores of the two sets of plans. The three objective indicators of noise signal-to-noise ratio and noise ratio showed only slight fluctuations. The noise value of the low-dose group increased slightly, and the remaining two objective indicators decreased slightly. The fluctuation range will not interfere with the doctor's observation and judgment of the internal components of the nodule boundary density. At the level of radiation-related indicators, all values in the low-dose group are much lower than those in the conventional-dose group, and the single effective dose is significantly reduced, with a considerable decrease. For middle-aged and elderly high-risk groups who need annual review, long-term cumulative radiation damage can be significantly controlled. The core reasons for this type of data discrepancy are divided into two levels. The iterative reconstruction algorithm can offset the signal loss caused by low-tube current acquisition and relies on background operations to filter out excess image noise to ensure that key nodule-related image information is completely retained. Lowering the tube current directly controls the total amount of X-rays released, and the level of ionizing radiation received by the chest tissue decreases simultaneously, taking into account the needs of screening and diagnosis and human body radiation protection. Conventional dose only has a slight advantage in image fineness. This advantage does not affect the core clinical diagnostic work and cannot offset the safety risks caused by long-term high radiation. Based on all the data obtained from this observation, corresponding clinical implementation suggestions are given for lung cancer screening in primary hospitals. Low-dose

chest CT scan parameters are preferred for normal screening of middle-aged and elderly high-risk groups in the hospital, and iterative reconstruction algorithms are unified to complete image post-processing. Pre-examination breathing training procedures are standardized to reduce motion artifact interference and ensure complete identification of micro-nodules.

5. Conclusion

In summary, in the diagnosis and screening of lung cancer patients, low-dose CT scanning technology can reduce radiation dose while ensuring detection and image quality, and has the potential to replace conventional doses.

Disclosure statement

The author declares no conflict of interest.

References

[1] Xu DQ, 2025, Comparison of the Application of Low-Dose and Conventional-Dose CT in the Identification and Invasive Diagnosis of Pulmonary Ground-Glass Nodules. Modern Medical Imaging, 34(11): 2016–2018 + 2024.

[2] Shen MH, Guo QQ, Wu XQ, et al., 2025, Analysis of the Diagnostic Value of Low-Dose Chest CT Examination for Early Lung Cancer. Chinese Medical Guidelines, 23(33): 77–79.

[3] Zhang B, 2025, Comparison of the Effectiveness of Low-Dose and Conventional-Dose CT Scans in the Diagnosis of Early Lung Cancer. Chinese Minkang Medicine, 37(21): 129–131.

[4] Cao WX, Chen MX, 2025, Research on the Balance of Radiation Dose and Image Quality in CT Low-Dose Scanning Parameter Optimization in Lung Cancer Screening. Imaging Research and Medical Applications, 9(18): 84–86.

[5] Tian J, Yang SH, Meng LL, 2025, The Value of Combined Ultra-High-Resolution CT and Low-Dose CT in Diagnosing Benign and Malignant Pulmonary Ground-Glass Nodules. Chinese and Foreign Medical Research, 4(18): 154–156.

[6] Liu XQ, Zeng Y, Guo RR, et al., 2025, Experience in the Application of Low-Dose Radiotherapy Combined with Immunotherapy in the Late-Line Treatment of Extensive-Stage Small Cell Lung Cancer. Life Science Instruments, 23(3): 13–16.

[7] Wu WJ, Zuo YY, Zhang H, et al., 2025, Comparison of the Application Effects and Incidence of Adverse Reactions Between Low-Dose and High-Dose Radiotherapy in the Treatment of Patients With Advanced Lung Cancer. Contemporary Medical Review, 23(15): 23–26.

[8] Wang Y, Li W, 2025, Application Value of Different Doses of CT in the Diagnosis of Pulmonary Ground-Glass Nodules. Imaging Research and Medical Applications, 9(9): 74–76 + 80.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.